VIDYASAGAR UNIVERSITY

MUGBERIA GANGADHAR MAHAVIDYALAYA

DEPERTMENT OF GEOGRAPHY

A PROJECT ON

COASTAL FOOLD IN KHEJURI COAST PURBA MEDINI PUR, WEST BENGAL

SUBMITTED BY

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PROJECT REPORT

ON

"Coastal flood of Purba Medinipur coast, West Bengal"

Department of Geography
Mugberia Gangadhar Mahavidyalaya

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This is to certify that Mr/Mrs ......Subhadip Kar.............. student of ....3rd year 6th sem....of the.....collage has successfully completed the project work entitled **"Coastal flood of Purba Medinipur coast, West Bengal"**

This project work is the record of authentic work carried out by him/her and is being submitted by him/her as a partial fulfillment of requirements of the award of UG degree. He/She has worked under my guidance.

Place...Bhupatinagar, Purba Medinipur, W.B.

Date....08/07/2022..........

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On

. **"Coastal flood of Purba Medinipur coast, West Bengal"**

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Introduction:-

A **flood** is an overflow of water that submerges land that is usually dry. In the sense of "flowing water", the word may also be applied to the inflow of the tide. Floods are an area of study of the discipline hydrology and are of significant concern in agriculture, civil engineering and public health. Human changes to the environment often increase the intensity and frequency of flooding, for example land use changes such as deforestation and removal of wetlands, changes in waterway course or flood controls such as with levees, and larger environmental issues such as climate change and sea level rise. In particular climate change's increased rainfall and extreme weather events increases the severity of other causes for flooding, resulting in more intense floods and increased flood risk.

Flooding may occur as an overflow of water from water bodies, such as a river, lake, or ocean, in which the water overtops or breaks levees, resulting in some of that water escaping its usual boundaries, or it may occur due to an accumulation of rainwater on saturated ground in an area flood. While the size of a lake or other body of water will vary with seasonal changes in precipitation and snow melt, these changes in size are unlikely to be considered significant unless they flood property or drown domestic animals.

Floods can also occur in rivers when the flow rate exceeds the capacity of the river channel, particularly at bends or meanders in the waterway. Floods often cause damage to homes and businesses if they are in the natural flood plains of rivers. While riverine flood damage can be eliminated by moving away from rivers and other bodies of water, people have traditionally lived and worked by rivers because the land is usually flat and fertile and because rivers provide easy travel and access to commerce and industry. Flooding can lead to secondary consequences in addition to damage to property, such as long-term displacement of residents and creating increased spread of waterborne diseases and vector-borne diseases transmitted by mosquitos.

The main types of floods:-

1. **Flash floods** are fast-moving waters that sweep everything in their path. They are caused by heavy rainfall or rapid snow thaw. Floods usually cover a relatively small area and occur with little to no notice, generally less than six hours. The rapid water torrents can move large objects such as cars, rocks, and trees.
2. **Coastal floods** are caused by strong winds or storms that move towards a coast during high tide. When powerful waves breach the coast's dune or dike, the area is usually flooded. Coastal areas with fewer defences and lower elevation are the most affected. The best time to repair the breach is during low tide.
3. **River floods** are characterized by gradual riverbank overflows caused by extensive rainfall over an extended period of time. The areas covered by river floods depend on the size of the river and the amount of rainfall. River floods rarely result in loss of lives but can cause immense economic damage.
4. **Urban floods** occur when the drainage system in a city or town fails to absorb the water from heavy rain. The lack of natural drainage in an urban area can also contribute to flooding. Water flows out into the street, making driving very dangerous. Although water levels can be just a few inches deep, urban floods can cause significant structural damage.
5. **Pluvial floods** form in flat areas where the terrain can't absorb the rainwater, causing puddles and ponds to appear. Pluvial flooding is similar to urban flooding, but it occurs mostly in rural areas.

Hence the project report consist on "**Coastal flood of Purba medinipur coast, West Bengal**" as a case study of disaster management about Flood.

Objectives:-

The project report will examine the application of innovative combined coastal mitigation and adaptation technologies generally aiming at delivering a safe (or low-risk) coast for human use/development and healthy coastal habitats as sea levels rise and climate changes (and the European economy continues to grow). The primary objective is to provide an integrated methodology for planning sustainable defence strategies for the management of coastal erosion and flooding which addresses technical, social, economic and environmental aspects. Project report objectives are three specific goals, which concern: (a) Risk assessment, (b) Response strategies and (c) Application. More specific project objectives under these goals are:

Risk assessment:-

01. To develop probabilistic tools for estimating hazard scenarios related to climate variability and change
02. To improve the knowledge of vulnerability and resilience of coastal defences and of coastal environment for the purposes of mitigation plans
03. To evaluate coastal flooding damages to infrastructure, environment and human activities; impacts on society, including change of social cohesion, livelihoods, and opportunities

Response strategies:-

01. To analyse innovative mitigation measures of erosion and flooding risk as the latest insights in coastal defence structures and coastline stabilization technologies (as reefs, resilient dikes, over-washed structures)
02. To propose and analyse a completely innovative solution such as the use of wave energy converters close to the shoreline for contemporary attenuating wave attacks and produce a secondary benefit
03. To design the engineering solutions in a way that minimizes environmental impact and maximizes wider benefits
04. To evaluate ecologically based measures as the role of habitat creation (reinforcement of saltmarshes and dunes, biogenic reefs) and the environmental effects of storm surge relief areas
05. To examine and set-up adaptation strategies as promotion of social resilience, insurance programs, spatial planning, evacuation plans and post-crisis response, managed realignment

Application.

01. To set-up "best practices" and prepare guidelines for the integrated design and application of efficient, equitable and sustainable coastal defence technologies
02. To set-up a portfolio of mitigation options for the society and the economy
03. To develop an integrated approach to select the sustainable defence strategy to face with coastal erosion and flooding in a given coastal area which addresses technical, social, economic and environmental factors
04. To validate this approach through applications in study sites, representative of different environmental, social and economic conditions, and to implement the integrated THESEUS software tool based on the developed approach
05. To promote coastal flooding resilience and disaster preparedness through education, training, development of best practices for organising post-crisis assistance and dissemination of project results

Location of the study Area:

India is blessed by a long shoreline enclosing the State from three sides, East, South and West. Compared to the western part, the eastern coast of the Indian subcontinent, experience lots of dynamism in terms of the coastal stability (Chatterjee, 1995). West Bengal has a substantially long coastline of almost 325 kilometres (including islands) characterized by high floral and faunal biodiversity, diverse geomorphic features and anthropogenic intrusions (Bhattacharya, 2001, Bhattacharya et al., 2003). The area selected for this study is the part of this extensive shoreline of Bay of Bengal along the West Bengal coast. This part is a coastal plain of west Bengal by the western bank of giant funnel shaped Hugli estuary, lying just too north of Bay of Bengal. The coastal area extending from Haldi River to Subarnarekha channel. Hence this area is frequently attracted by cyclones that take of course along the Hugli estuary. Historically important this coast and some devastating cyclones like Calcutta cyclone (1737) Midnapore cyclone (1864, 1942) Sundarban cyclone (1988 and 1989), Aila (2009), Amphan (2020), YAAS (2021) many other cyclones occurred during October to November and even "struck along estuarine location. As a result, the vast areas of the coast are destroyed many plants, coastal erosion, storm surge and shoreline change, etc.

LOCATION MAP OF THE STUDY AREA

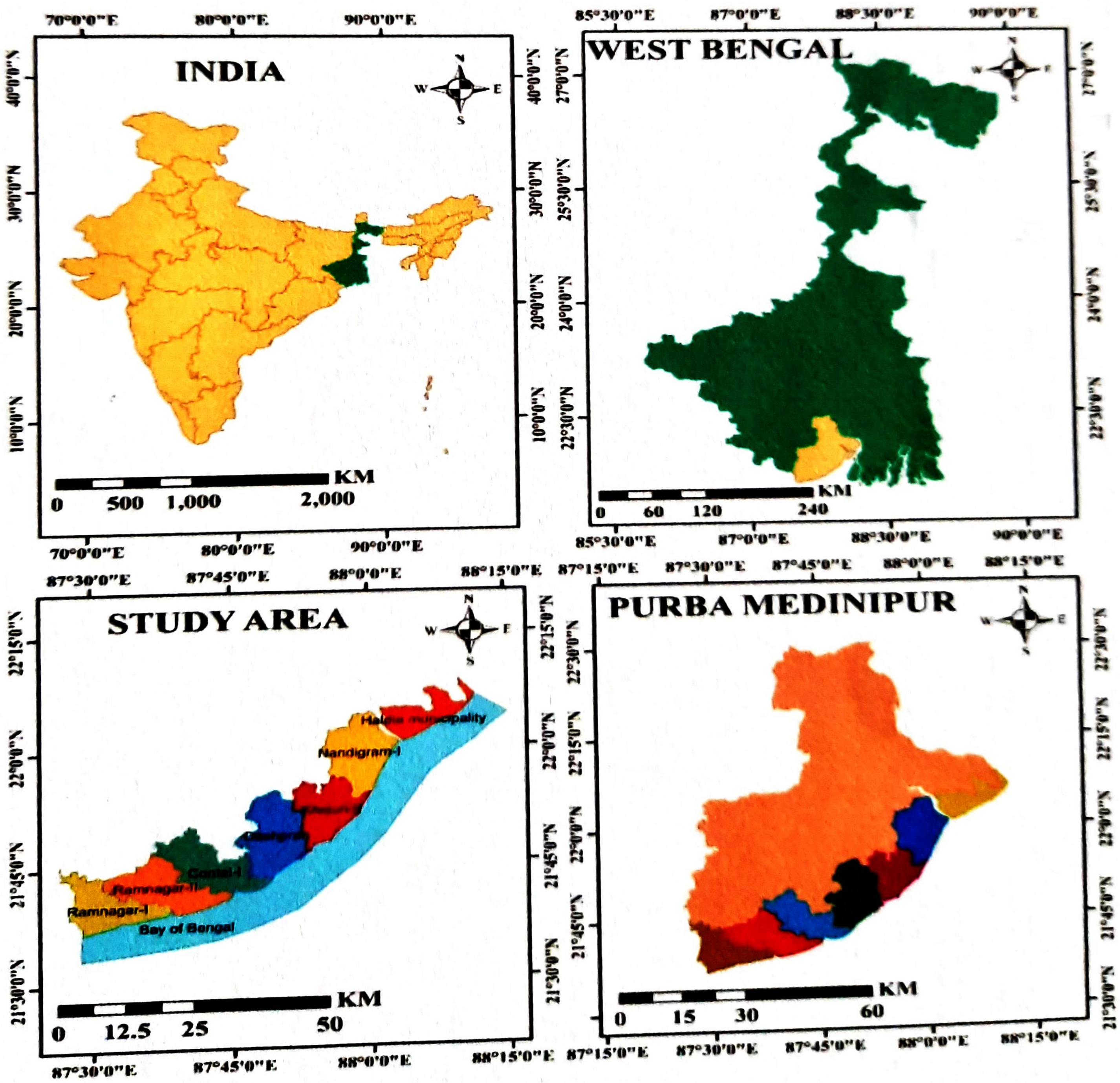


Fig: Location Map of the study area.

Physical characteristics of the study area

Geology:-

As per the Geological Quadrant map, the entire Purba Medinipur district is originated with the composition six different types of geological formations during the Late Pleistocene to Late Holocene period.

Period	Geological formation	Materials
Late Holocene	Beach formation	Very fine, white to grey sands mixed with clay

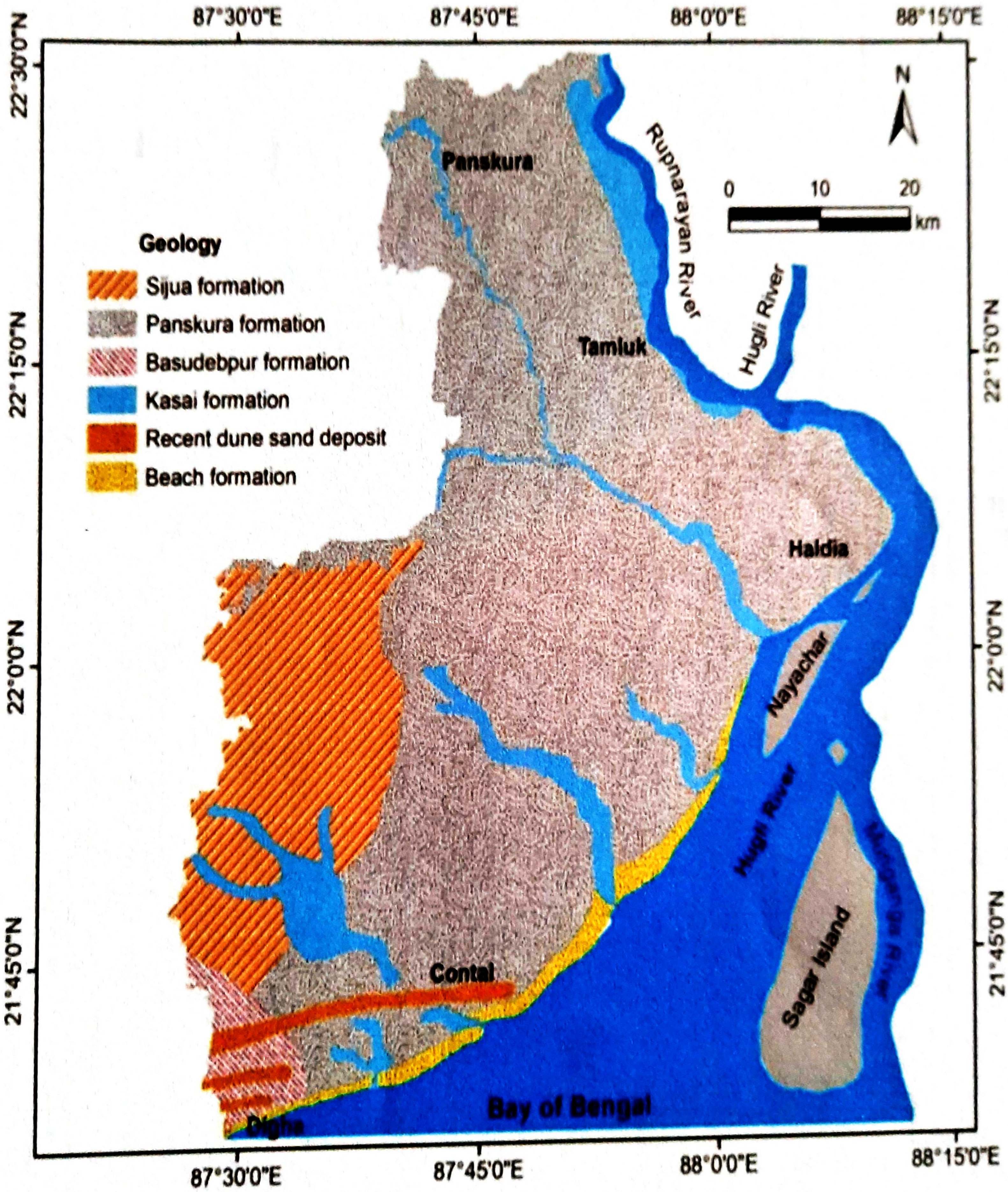


Fig. Geological formation of the Purba Medinipur district (south-eastern coastal plain of west Bengal)

Geomorphology:-

With the help of Google Earth image and other existing sources of literature, the 17micro-level geomorphological features are explored for the entire Purba Medinipur district

Sl no.	Geomorphic features	Area(Km²)	Region
01	Beach	2.96	Main coastal regional landform
02	Beach ridge with sand dune	136.17	
03	Holocen tidal deposit	245.60	
04	Mudflat	12.79	
05	Recent tidal deposite	38.67	
06	Swale	3.18	
07	Swamp	15.78	
08	Mature swamp	43.72	
09	Tidal channel	63.12	
10	Ancient delta (Subarnarekha)	283.90	
11	Ancient tidal deposit	768.90	Sub coastal regional landform
12	Lagoonal deposit	671.74	
13	Levee deposit(rupnarayan)	187.38	
14	Palaeo channel with levee	514.02	
15	Holocen fluvial deposit	347.44	
16	Basinal deposit (Rupnarayan-Kasai)	465.70	
17	Fluvial deposit (Kasai)	92.39	

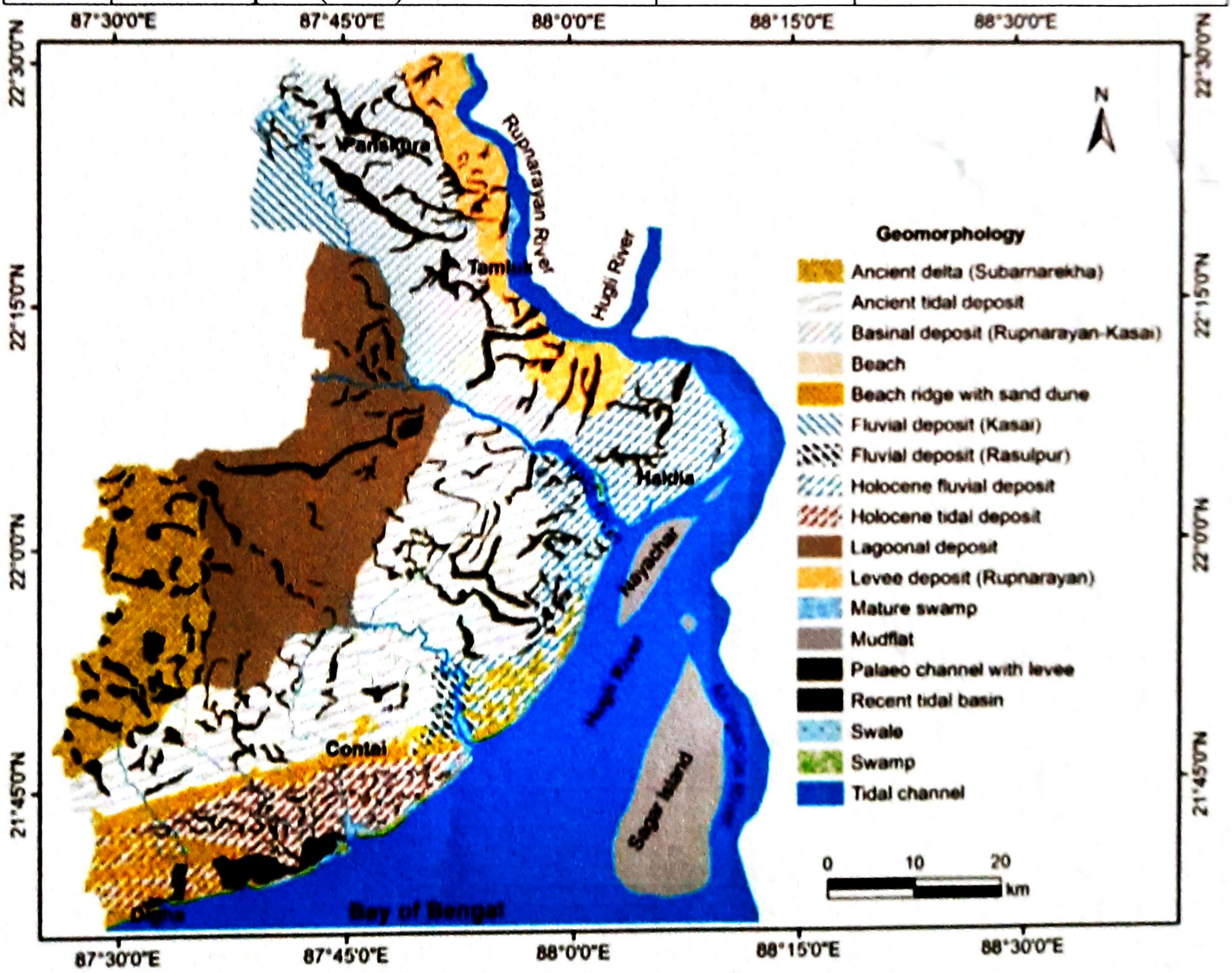


Fig. Geomorphological diversities in Purba Medinipur district with the study areas.

Drainage

The major rivers of the Purba medinipur district are Rupnarayan, Hugli, Kasai, Haldi, Rasulpur, and Champa. Moreover, the coastal plain of purba medinipur district is separated into different segments by a number of drainage channels like Jatra nullah, Champa River, Jaldah estuary, Pichaboni estuary, Rasulpur River, Talpati channel and Haldi estuary. The Coastal segments remain as basins in-between consecutive tidal rivers towards the shore Fringes. Most of the channels are dissected by Hijili tidal canal and Odisha Coast Canal at Shore parallel locations (Rudra, 2018; Duari, 2019). The tidal prism, active siltation process and Spilling tides into the basins are controlled by the activity of drainage channels in the low-lying Coasts. The loss of tidal drainage may produce extensive salt flats in the expanse of mangrove Wetlands of the coastal belt. They also act as run-off channels during monsoon rains to support the mangrove habitats of the coast.

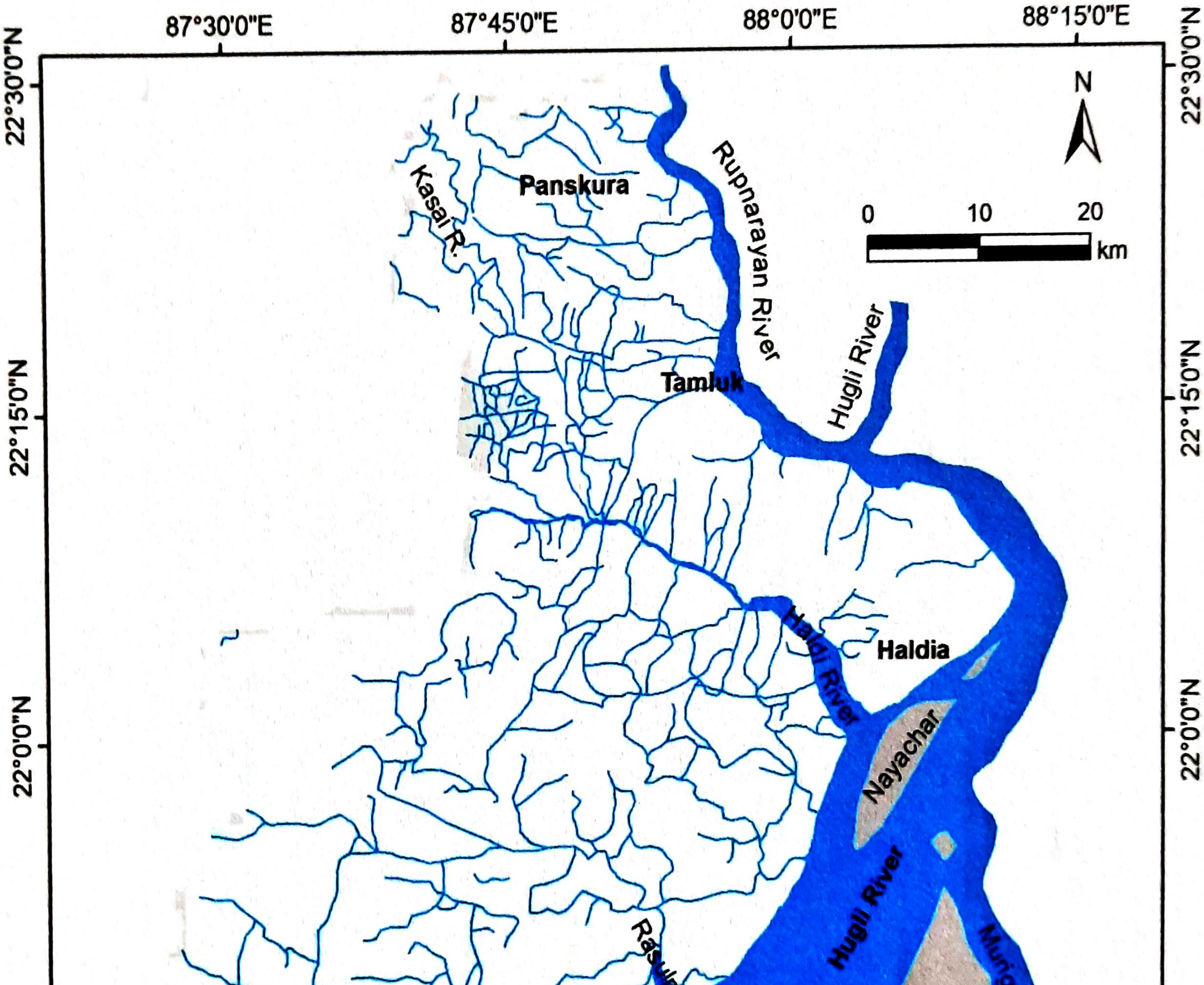


Fig: Drainage systems of the Purba Medinipur district with location of study areas

Climate:-

The marine influences are observed in the tropical hot and humid climate of the region. The monsoon months extend from June to November and they produce the maximum percentage of annual rainfall in every year particularly during arrival and retreating phases. Formation of depressions and cyclones in the northern Bay of Bengal produce some amount of rainfall at the beginning and at the end of monsoon season in the coastal belt. The remaining months from December to May behave as a dry condition in the region. Depending on the IMD

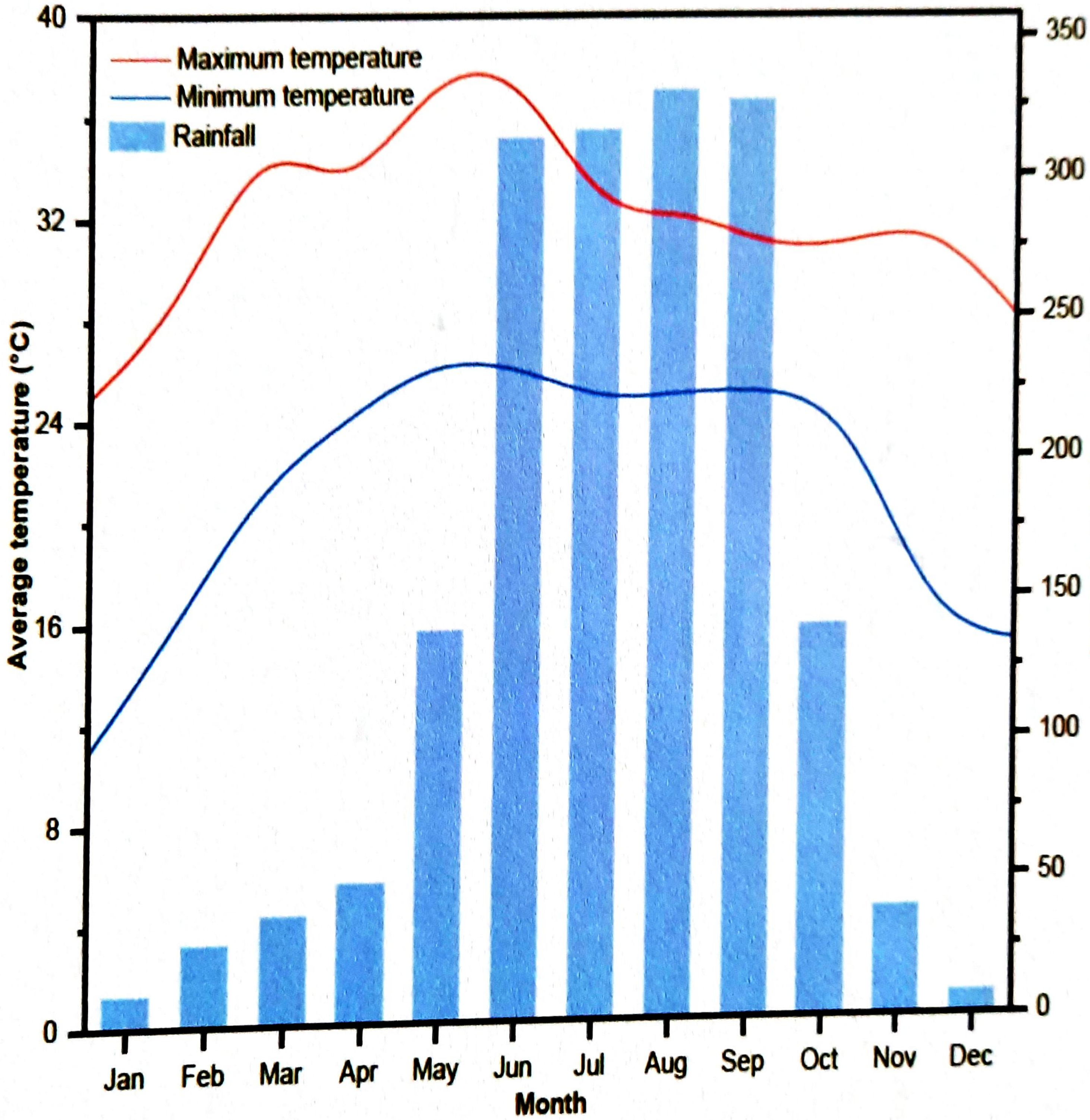


Fig. Month-wise variation of average rainfall and temperatures during 1949 – 2017 of the Purba Medinipur district.

Temperature:

- Maximum: 37°c (June-July)
- Minimum: 11°c (January)
- Annual average: 26.5°c

Rainfall

- Maximum: 330.8 cm (August)
- Minimum: 8.50 cm (December)
- Annual average: 145.67cm

Soil

Within the entire Purba Medinipur district ten major diversified soil types have been found based on the National Bureau of Soil Survey and Land Use Planning (NBSS & LUP). Most of the areas (1777.08 km²) remain under the fine vertic haplaquepts type of soil. The other nine soil types with taxonomic name, their material composition and hydrological characteristics, and the spatial extents are also assessed.

Major Soil types of Purba Medinipur district

Coastal Area	Sub-Coastal Area
Aquic ustipsamments	Fine vertic haplaquepts
Fine loamy typic ustifluvents	Typic ustipsamments
Fine aeria haplaquepts	Very fine aeric haplaquepts
Typic haplaquepts	Very fine vertic haplaquepts
Fine typic haplaquepts	Fine vertic ochraqualfs

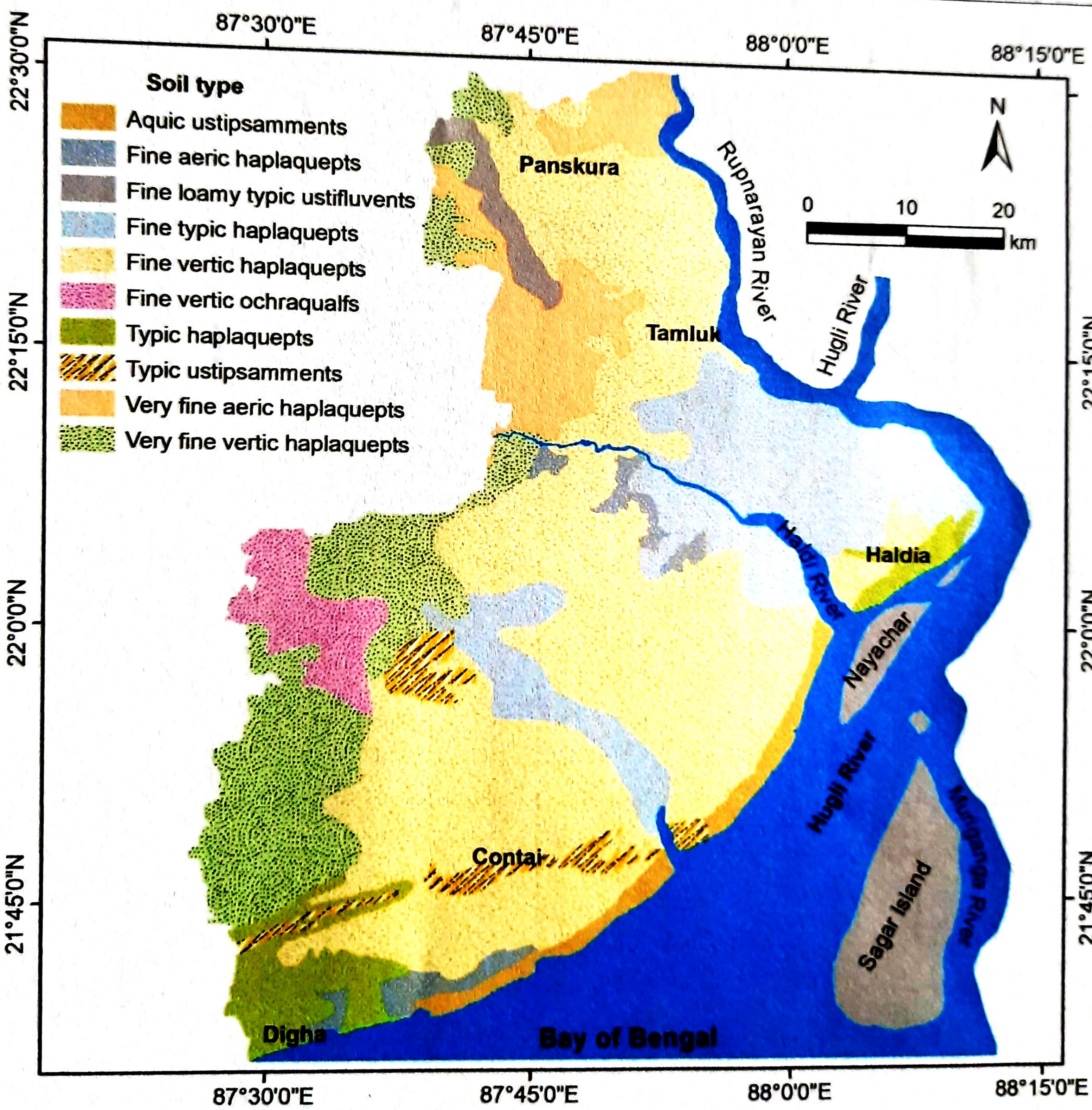


Fig: Diversity in soil types of Purba Medinipur district with location of study areas.

Methodology:-

Project report on **"Coastal flood of Purba Medinipur coast, West Bengal"** has been conducted through some sequential and systematic methods. This method may be divided in to three categories which are given below.

A. Pre Field Stage: - In this stage some activities have been done for field works preparation. Such as -

- Planning for micro level minor research project.
- Selection of the project tropic.
- Selection of the study area.
- Making survey schedule for field survey and discussion of field stage etc.

B. Field Stage: - In this stage we have completed some activities through different methods, these are given below-

- Direct observation of physical and anthropogenic landscape.
- Collection of secondary data from corresponding block office.
- photograph collection of above area.
- Plot to plot land-use survey.
- Door to door survey for socio economic survey in this village.

C. Post Field Stage: - Post field stage is actually final process about the field survey this is given below-

- Tabulation of collecting primary data.
- Modification of primary data and justify with secondary data.
- Data analysis and graphical representation.
- Ground photo selection.
- Data interpretation and making the project report.

Tools for the Field Study: -

Essential required tools for the field study are given below-

- Note Book, Pen, Pencil, Rubber, Scale Etc.
- Atlas Map, Topographical Map, Google Map, Satellite Image,
- Binocular,
- Zoom Camera
- GPS
- Climatic Chat
- District Handbook
- Survey Schedule

Data Collection:-

Qualitative and quantitative data are essential for the project report so data collection mainly conduct on Primary data collection on the base of observation, interview and sample survey method and Secondary data collection on the base of district handbook and block office.

Analysis of data:-

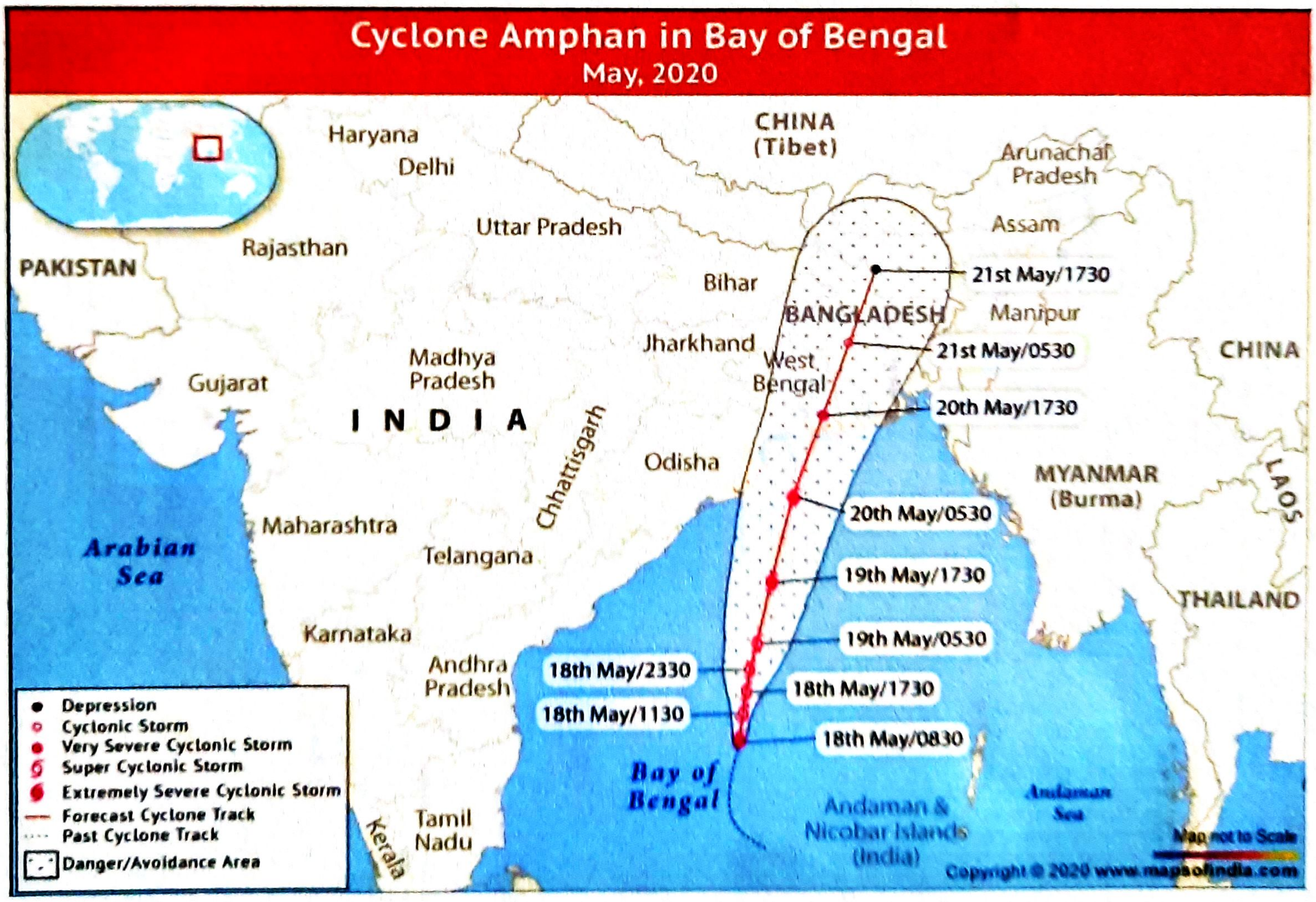
Causes of Coastal Flooding: - Coastal floods are caused by extreme sea levels, which arise as combinations of four main factors: waves, astronomical tides, storm surges and relative mean sea level. The additional influence of river discharge may also be important in some estuaries.

Many factors can cause flooding in coastal areas. They include:

- high astronomical tide
- high storm surge
- large waves

1. High astronomical tide:-High astronomical tide is caused by normal variations in the astronomical tide cycle. The cycle is influenced by the alignment of the Sun and Moon with the Earth. High astronomical tide increases the risk of floods during a storm (Tidal bore).

2. Storm surge:-Storm surge is a rise above normal coastal water levels. It's caused by a combination of wind action and low pressure acting on the ocean's surface. Storm surge is often caused by severe weather conditions. These are tropical cyclones (such as **Amphan** and **Yass**).



3. Large waves:-Local winds or swells from storms far away cause large waves. A 'large wave' rises above normal coastal water levels. They often occur under the severe weather conditions mentioned above.

In study area major flood occurs on storm surge and High astronomical tide in monsoon season.

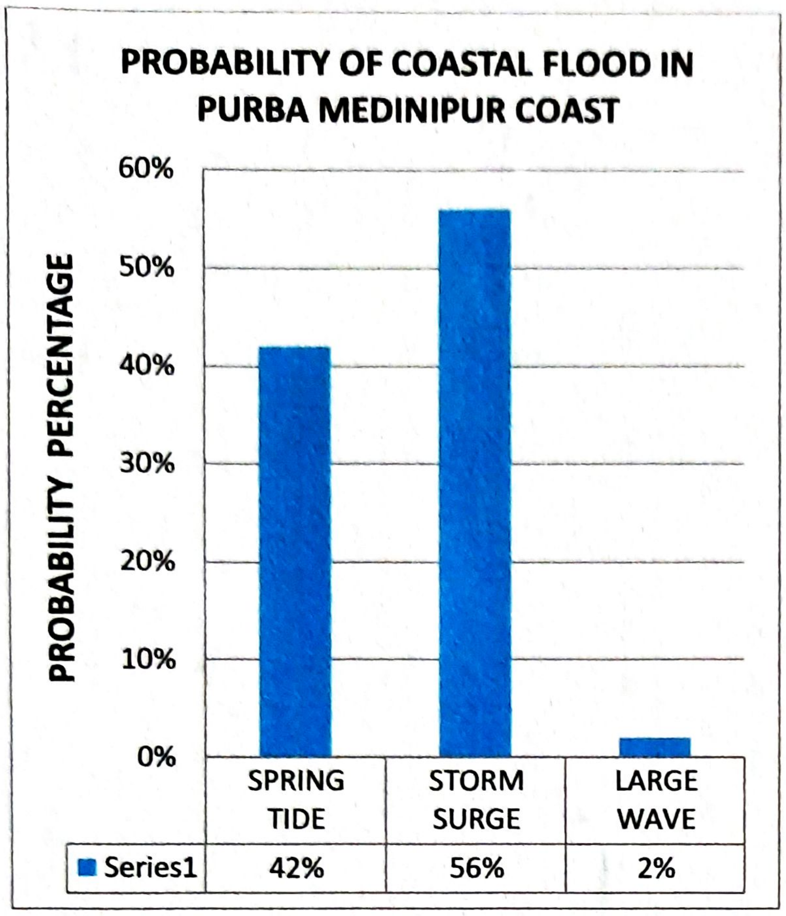


Fig. Cause of coastal flood in Purba Medinipur coast.

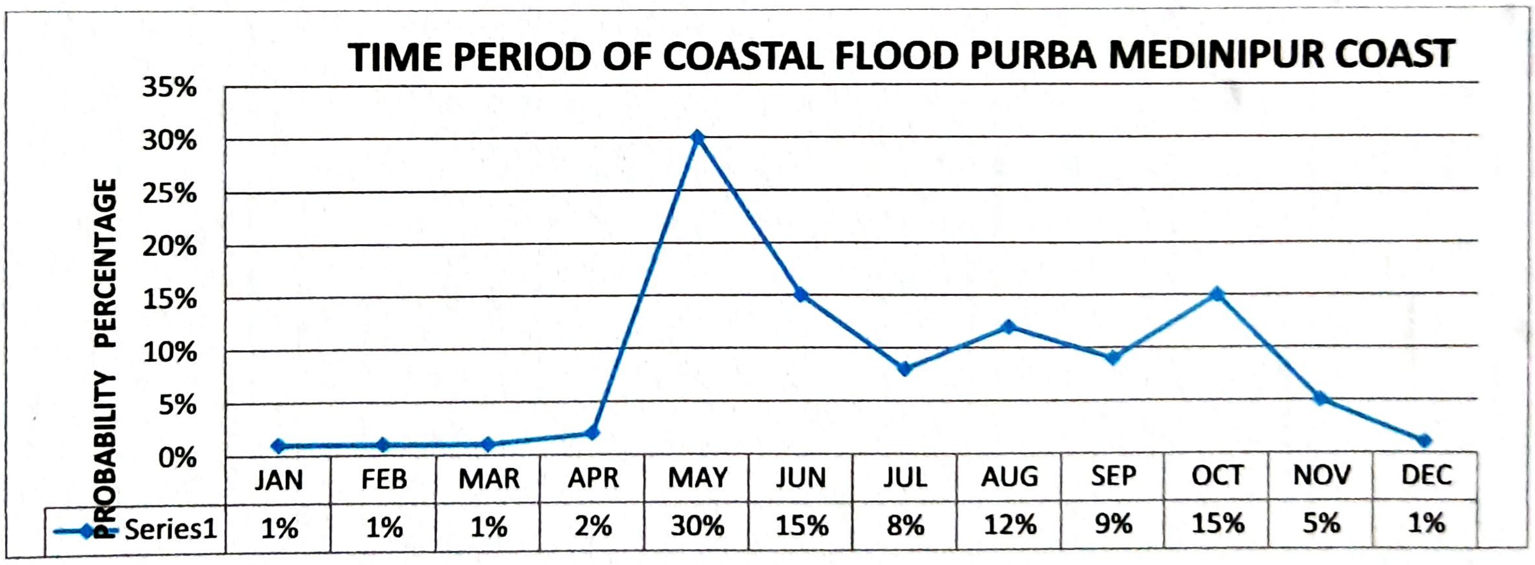


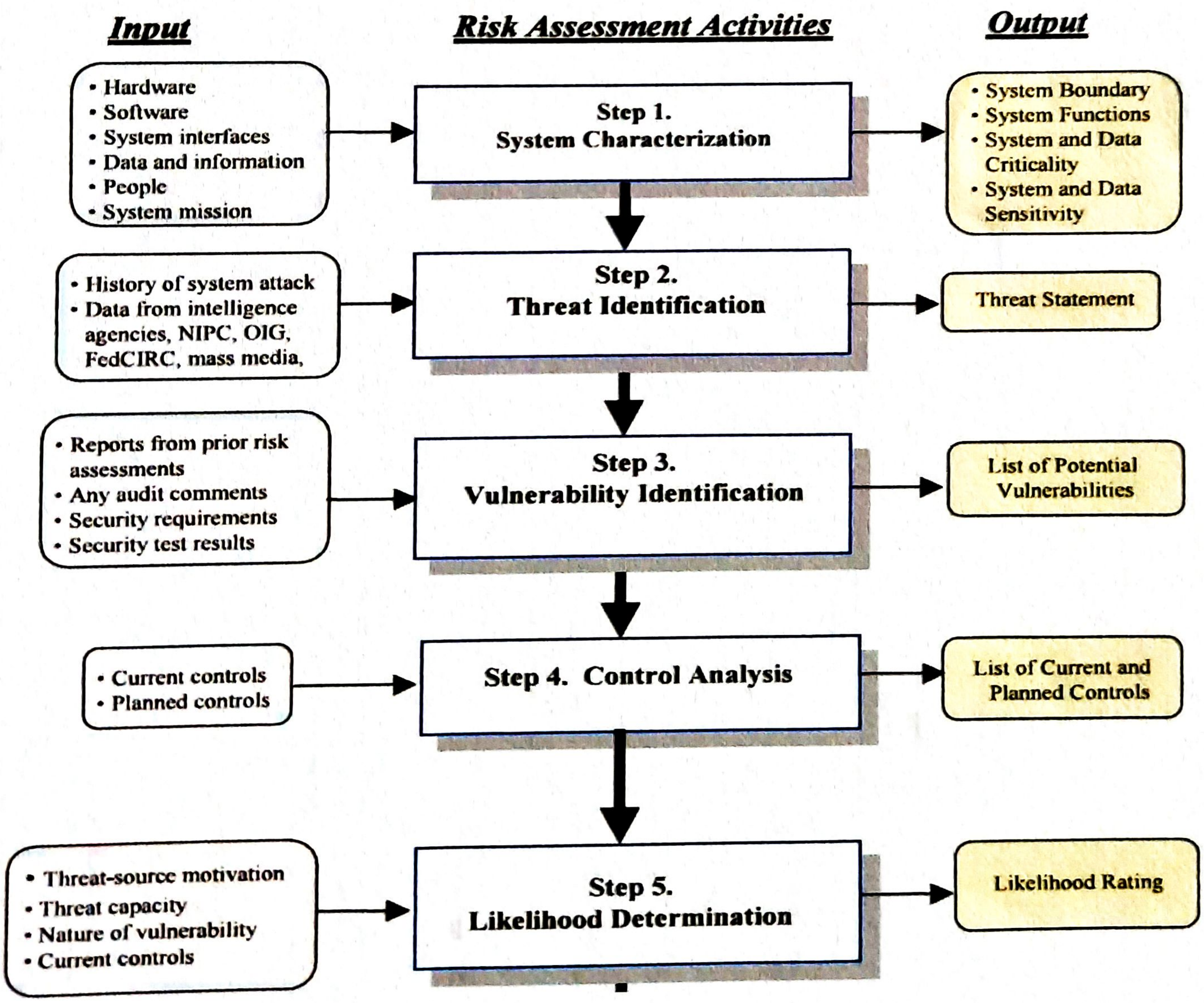
Fig. Time period of coastal flood in Purba Medinipur coast.

Risk assessment:-

2.3. Assessment of Flood Risk in the Study Area Risk is the probability of expected losses of inhabitants by the interaction between hazard and their vulnerable conditions (International Strategy for Disaster Reduction (ISDR); United Nations Development Programme (UNDP) Wisner et al. The probability of risk is varied from one community to another community. The potentiality of risk is not the same for different hazards even in the same region or in the same community and thus risk was determined by two components: hazard and vulnerability.
According to ISDR, the equation of risk is

$$R = H \times V \quad \text{equation no. 1}$$

Where, R is risk, H is hazard, and V is vulnerability. Here, Equation (1) is used to understand the flood risk in the case study of Purba Medinipur district. Pistrika and Tsakiris, and Cançado et al. Also used this equation in the flood risk assessment study. Thus, if there is no hazard in any region, following the above equation, the risk of this region is zero. Shows the conceptual model of flood risk assessment applied in this study. Before calculation of the flood risk, it is necessary to know the existing adopted score of hazard and vulnerability in the study area.



Fig, Conceptual framework of risk assessment

Flood Hazard Assessment: -

Hazards are potential damaging events, phenomena, or actions that may cause loss of life, injury, property damage, socio-economic disruption, and environmental degradation with the propagation of its development. In this study, flood hazard was measured by the repetition of inundation conditions. Flood frequency analysis is a technique that advocates the occurrence of a flood in a particular span of time. Owing to its unique hydro geomorphological characteristics, the vast area of the district has recurring inundation with varied magnitude. In the present study, the inundation condition was segmented into three groups, i.e., large floods which have devastating nature and require relief and support, medium floods which lead to agricultural failure, and small floods which show the simple inundation condition. To measure the flood frequency in the study area, all the large and medium floods as recognized by district administration were considered. Comparatively large floods occur less frequently than medium and small floods. In this study, the number of floods that occurred between 2002 and 2019 were considered as flood frequency for each block. The idea of flood frequency is used here to predict the structural failure by flood event along the riverbank, like damage to buildings, roads, highways, embankments, etc. Analysis of flood frequency also helps engineers design safeguards to prevent structures from being damaged and protects against economic losses. Flood hazard index (FHI) is an indicator used to explain the different intensity or frequency of a flood in a particular geographical setting. Using the hydrological model and statistical methods in GIS platform, the FHI was calculated by Asare-Kyei et al. and the resultant value of FHI varied from 1 (very low flood hazard intensity) to 5 (very high flood hazard intensity). Kabenge et al. used geoformation based FHI for the Nyamwamba watershed in Uganda. In the present work, resultant values of FHI were classified into five different categories, i.e., very low, low, medium, high, and very high and weighted values were defined as 1, 2, 3, 4, and 5 respectively.

Frequency of flood(in eighteen years)	Hazard classes	Hazard Index
<6	Very low	1
6-7	Low	2
8-9	Medium	3
10-11	High	4
>11	Very high	5

Vulnerability Assessment

Vulnerability assessment is an integral part of flood risk analysis. Reduction of vulnerability is a core element in reducing disaster-related risk and it was identified as the most important precondition for resilience of disaster-prone areas. Vulnerability is the set of conditions and processes resulting from physical, social, economic, and environmental factors, which increase the susceptibility of a community to the impact of hazards. To measure the vulnerability in the selected study area, 25 indicators were employed for positive relationship, vulnerability increases with the presence of indicator whereas for negative relationship, vulnerability decreases with increasing value of indicator.

There are many methods for data normalization like z score, min-max rescaling transformation, maximum value transformation, etc. The normalization of vulnerability indicators is carried out through the min-max normalization method. In this method, data are transformed to a specific range

(0–1), which confirms that all the features have the exact same scale. Min-max rescaling transformation is determined by the following Equations (2) and (3).

$$\text{For positive relationship, } x = \frac{Xi - Min}{(Max - Min)} \qquad \text{equation no. 2}$$

$$\text{For negative relationship, } x = \frac{Max - Xi}{(Max - Min)} \qquad \text{equation no. 3}$$

Where,

x = Normalized value of indicator,

Max = Highest value of the indicator within all blocks,

Xi = Actual value of the indicator,

Min = Lowest value of the indicator within all blocks,

Vulnerability index.

Standard Deviation	Vulnerability Classes	Vulnerability Index
<-1.5	Very low	1
-1.5--0.50	Low	2
-0.50-0.50	Medium	3
0.50-1.5	High	4
>1.5	Very high	5

In the study area different vulnerability index given below

Name Of The Block	Standard Deviation	Vulnerability Class
Ramnagar-I	**0.5-1.5**	**High**
Ramnagar-II	**-0.5-0.5**	**Medium**
Contai-I	**<-1.5**	**Very Low**
Deshapran	**-0.5-0.5**	**Medium**
Khejuri-II	**>1.5**	**Very High**
Nandigram-I	**>1.5**	**Very High**

Response strategies:-

Various type of response are require for a disaster management like as foods and response, cloths and response , shelter and response are very important. In the study area different type of response found in yaas coastal flood.

Pre-disaster Response: - This response conduct on pre disaster period. In the study area in every year coastal flood is common disaster. In present day government take awareness programme by the modern technology.

During disaster response:- This response conduct on during disaster period. In this time NDRF & SDRF team to help local people for shelter in safe zone.

Post disaster Response: - This response conduct on after disaster period. In the study area coastal flood is common disaster in every year. Various type of post disaster response after yaas cyclone and coastal flood above area.

Ramnagar-I Block

1.6.21-22 tarpaulins were distributed for the beneficiaries of Jaldha, Jhaugeria villages of Talgachchari-II GP.

3.6.21- 3 tarpaulins were distributed at khadalgobra village in Kadima - I GP.

6.6.21- Around 400 flood affected victims, most of them small-scale fish workers, took refuge at makeshift tents on the sea-dyke near Jaldha-Tajpur Crossing since 26.05.2021. The local community members, organizations and clubs made helped these people in distress. On 6.6.2021, DISHA, in association with Dakshinbanga Matsyajibi Forum, distributed cooked food among them.

Ramnagar-II Block

29.05.2021 – Cooked food was provided to 450 families at relief camps of Dakshin Purushottampur (Arakbania) at Kalindi GP. The initiative was supervised by Kanthi Mahakuma Khoti Matsyajibi Union and supported by Sarat Smriti Sangha of Dakshin Tentultala.

30.5.2021 - 24 tarpaulins were distributed at Dakshin Purushottampur and Dadanpatrabar village under Kalindi GP.

1.6.2021 –A total of 410 fish workers of Soula-II, Cheoyasuli–I & II, and Dandanpatrabar fish landing centres (325 beneficiaries from Soula-II and Cheoyasuli-II and 85 beneficiaries from Cheoyasuli-I and Dadanpatrabar) were provided food packets (Poha, Puffed rice and Biscuits), Soap and garments.

80 sanitary napkins were also provided at Dadanpatrabar. The initiative was supported by DISHA, Dakshinbanga Matsyajibi Forum and Amra Kajan, Kolkata. On 6.6.2021, 2 bags each of bleaching powder and lime was distributed at Dakshin Purushottampur village.

06.06.21 –Food rations of Muri, Chire, Chanachur, Soyabean, Potato, and Biscuits; soap, sanitary napkin, mask and old clothes were distributed at Dadanpatrabar primary school to 50 flood affected families. The program was supported by Sankalpa Foundation of Paschim Medinipur.

Contai-I Block

30.5.2021 – In association of a local club called "Chalo Paltai", reliefs were provided to the fish workers of Baguran Jalpai and Soula-I fish landing centres.

09.06.2021 –Dry food, ORS and medicines were distributed among 100 fish worker families at Baguran Jalpai village in association of Mariners of Bengal.

Desapran Block

2.6.2021 - 7 tarpaulins were distributed at Bhogpur village in Dariyapur block. Further, on 09.06.2021, 13 tarpaulins were distributed among the fish worker families at Bhogpur and Dahasunamoi village.

10.6.2021 – 31 tarpaulins were distributed at Dariyapur GP. Beneficiaries from Haripur, Pratappur, Ramchak and Gopalchak villages attended the program.

11.06.2021 – 30 tarpaulins were distributed to cyclone affected fish worker families at Haripur village.

Khejuri II Block

30.5.21 - With active support from Give Foundation (Karnataka) and Program for Social Action(PSA), Delhi, 150 beneficiaries from Khejuri, Nijkasba, Aragbari, Bansbasuria, Thanabari, Kaukhali, WayasilChak, Purba and Paschim Panchuria gram panchayats were provided food packets (Rice, Potato, onion, Mustard Oil, Sooji, Sugar, Soybean, Lentils, Spices, Salt, Biscuit), Soap & detergent, bleaching powder and lime. 55 tarpaulins were also distributed. On the same day, 25 tarpaulins were distributed at Thanaberia Fish Market, Khejuri II block.

31.5.2021 -120 packets of dry food, drinking water packet, 50 tarpaulins and 32 printed sarees were distributed to the small scale fishworker families of cyclone affected areas of Kaukhali, Arakbari, Thanabera, Wasilchak, Paurba& Paschim Pachuria, Nankar, Govindopur villages of Khejuri -II block by the Paschim Medinipur District Branch of Dakshinbanga Matsyajibi Forum and Kashinath Acharya Memorial Society, with active support from Medinipur Chhatra Samaj.

Nandigram – I Block

09.06.2021 – 15 tarpaulins were distributed among the fishworker families at Kendamari village of Nandigram-I block.

Limitation:-

In the project work have some dispute in different aspect because the study area is very large , secondary data are not fulfil by the government office ,local people are not conscious and concept about risk assessment with vulnerability assessment and time period of the study is very short etc..

Conclusion:-

Risk assessment is essential for planning and development initiatives in flood prone areas. In this study, flood risk is represented as combined effort of flood hazard and vulnerability assessment for the tropical monsoon region. Here the risk is not only related to the hazards but also to the understanding of the vulnerability of the community, which indicates the exposure scenario of that society. Ramnagar-I is very high flood risk zone and Khejuri-II and Nandigram-I high flood risk zone by the coastal flood in the other hand vulnerability index is very high in Nandigram-I and Khejuri-II block .This disaster is common matter of Purba Medinipur coast as well as other coastal area . It is say that some structural and non-structural measurement is immediate take by the government in above area to proper management of the disaster. Proper steps are necessary to reduce floods and their vulnerability in high risk regions, and this work could provide an opportunity to develop integrated flood-risk plans for the Purba Medinipur district. Thus, flood risk assessment through flood hazard and vulnerability can provide a useful attempt at natural resource management and it is also essential to improve the livelihood of people at the micro level.

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