

GEO-SPATIAL MODELLING FOR PALEOCHANNELS OF THE RIVER: A CASE STUDY OF THE ANJANA RIVER OFFTAKE OF NADIA, WEST BENGAL, INDIA.**Dr. Raja Ghosh,**Assistant Professor & Head, Department of Geography, Kshudiram Bose Central College,
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Abstract: Nadia is the land of rivers like the River Bhagirathi, River Mathabhanga, the River Ichamati and the River Jalangi, the River Bhairab, the Churni. There is another river Anjana which is originated from river jalangi. Anjana, once the mainleft side stream line figure of river Jalangi, has now become a narrow canal. As per records of Nadia district, the then voluminous river Anjana was the only short cut to go from one side of the district to other, and also it maintained the water balance between river Anjana and river Churni at the time of Monsoon. It used to carry abundant water from the Jalangi to the Churni, thus maintaining the water balance between these two Rivers. The main channel of Jalangi is characterized by intense meandering and the channel has shifted a few times in the recent past. This fact is confirmed by the presence of ox-bow lakes, meander scars etc. near the main channel. It can also be found from the old maps of the 18th and 19th century that width of the Jalangi river channel-which was at a par with the Bhagirathi-Hugli River until a couple of centuries back-has been decreasing. Jalangi is a distributary of the Padma River which has opened up within the last few hundred years to flow actively in the southern and south-western direction through the districts of Murshidabad and Nadia in West Bengal. Initially, its source was the original Jalangi offtake located near Jalangi village, Murshidabad district. Earlier, it used to meet Bhairab River at two different points 5 km apart. But due to irregular flow of water, this part of the Anjana River has become a paleochannel and the discharge through Jalangi River is now maintained by Bhairab River. The anthropogenic impact is mostly visible in the areas near Krishnanagar city. Significant changes in the general health of the channel occurred in the upper course of Anjana and that part has become a paleochannels during the course of time. Flood appears to be a major threat for the region during the monsoon season and a substantial proportion of land remains inundated for a long time if a major flood occurs. But even a high intensity extreme flood event may not bring about long-term changes in the channel morphology of Anjana. Location and arrangement of the brick fields, occurrence of water hyacinth, usage of river water for sanitation purpose etc. further degrade the health of Anjana River. Anjana River still acts as a necessary component for the people of Nadia district. Human beings carry out different activities depending solely upon this river. So, even though the discharge through Anjana is satisfactory during the monsoon season, there is every chance that the river could turn into an abandoned one in the near future. The consequences could be really hazardous and could severely disrupt the eco-systems in the region. The curative measures with proper planning and management could be suggested to regenerate the river environment.

Keywords: Channel Morphology, River Health, River Eco-System.

1. Introduction of Paleochannels of the River Anjana in Nadia:

The main channel of Anjana is characterized by intense meandering and the channel has shifted a few times in the recent past. This fact is confirmed by the presence of ox-bow lakes, meander scars etc. near the main channel. It can also be found from the old maps of the 18th and 19th century that width of the Anjana River channel-which was at a par with the Bhagirathi-Hugli River until a couple of centuries back-has been decreasing. Human beings

have an impact on river. The significance of human impact on river are largely negative. Human agriculture, industry introduces lots of pollution. Water is most vital element among the natural resources and is crucial for the survival of all living being.

2. Review of Selected Literatures:

Many researchers have been completed work on water pollution. Anil Kumar Mishra, have researched on river Yamuna Hirst, F.C. (1915) in his paper he has taken different water quality parameter. These are follows biological oxygen demand (BOD), chemical oxygen demand (COD). BOD measures the rate of oxygen used by biological organisms in the water body to decompose the organic matter polluted by sewerage. COD beyond the permissible limit is the indicator of the organic and inorganic pollutants in the water body. Industrial effluents, domestic waste water, pollution from agriculture is affected Yamuna River mainly. A river about to die: Yamuna Bakr, M.A. (1971) has also done his work based upon Anjana River. Anjana river now become a cannel. This river balance water between river jalangi and river churni at the time monsoon. Loss of water in ganga river, alluvial deposits in source point, Tilt of Bengal basin, impact of farakka Barrage are the physical factors and encroachment, barrier and barricades water are the human factors these factors are responsible for degradation of Anjana River. The Anjana River is a connection between river Jalangi and river Churni. Thus, it maintains the water balance at the time of monsoon. The river was a good medium for water transportation mainly for trading. The water of the river was also used in irrigation. There was abundance of fishes. Thus, the river had a great socio-economical as well as ecological significance. But the increased population and occupancy of the river bank transform this healthy river into a narrow, degraded canal.

3. Materials and Methods of Data Base: Collection and integration of remote sensing and GIS data:

Discharge data of different periods have been used for identifying the variation of water flow through the main channel. The main channel of Anjana is characterized by intense meandering and the channel has shifted a few times in the recent past. This fact is confirmed by the presence of ox-bow lakes, meander scars etc. near the main channel. It can also be found from the old maps of the 18th and 19th century that width of the Anjana River channel- which was at a par with the Bhagirathi-Hugli River until a couple of centuries back-has been decreasing. ARC GIS (version 10) developed by ESRI Inc. and ERDAS Imagine developed by Leica Geosystems Ltd. also used in the present study for data processing and preparation of the LULC at micro-level, i.e., ground level. Selected field verification has made as and when required. According to J. Rennell's Bengal Atlas (1780), Atlas of India maps (1855), Topographical maps of 1: 63,360 scale (1914-18), and Satellite database includes Landsat (MSS, TM, ETM+) images (1973:2010) and LISS IV Mono images (2007) have been used for this research.

Table 1: Materials and Methods of Data Base

Sl. No.	Data Type	Spatial Resolution (Meter)	Sources	Year	Data Format (After Image processing)	Application
1	LANDSAT (4-5) TM	30x30	USGS	2016, 2017	Raster (. Img)	Urban LULC Map
	LANDSAT (7)	15x15				

	ETM+	(pan) 30x30				
3	IRS P6 LISS III (Resourcesat-1/Resourcesat-2)	23.5x23.5	NRSC	2014-2015	Raster (. Img)	Inland water Body Identify
4	Geo Eye	0.5m	Google Earth	2005-2018	Raster/vector (. Img / . Shp)	location identify, LULC Analysis

4. The Study area:

The source of the river is Anjana River; Lat 23°25'11.46''N and Long 88° 28'57.92''E. The source of the river remains invisible most of the time of year. From its source point the river first flows to the north and then cross the Bunglow of Nadia Police Super then it flows to the eastern side. Then the river passes through the Krishnagar Municipality and the villages such as Dogachhi, Khirpuli, Hatboalia, Jalalkahali, Dharmmadaha, Patuli, Ballabpur, Badkula, Gangni, Mugrail, Gagakhali, Byaspur. On the way of its flow, it became bifurcated. One flow goes to the eastern direction name Sonamukhi and the other flow goes to south as Anjana. After flowing 29 KM it meets to the river Churni; Lat 23°16'56.25''N, 88°35'01.51''E.

5. Aim and Objectives of the study area:

- i. To analysis the land use and land cover map from satellite image.
- ii. To prepare a change detection map of Anjana River basin from year 1989 to 2022.
- iii. Select three classes low to no change, moderate to low change, high to moderate change.
- v. To discuss about how Anjana River give impact these study areas.

GEOGRAPHICAL LOCATION OF STUDY AREA:

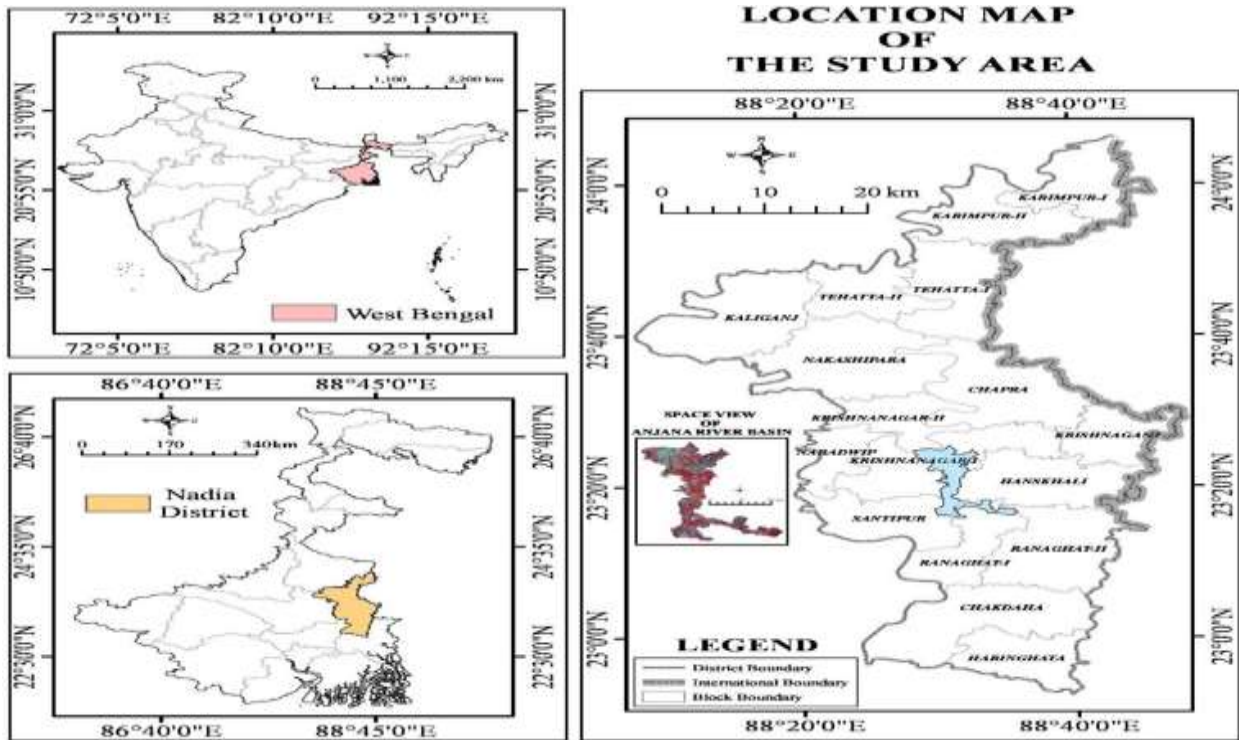


Fig. 1: Location of the Study Area

6. Analysis and Discussion:

Anjana flows through the moribund portion of the southwestern GBD as found from the three-part division of southwestern GBD made by Bagchi (1944). Jalangi, along with Mathabhanga and Bhagirathi formed a network of moribund rivers in the concerned region for study and are still collectively known as the 'Nadia Rivers' (Hirst, 1915). These rivers were the most important means of communication until the advent of railways.

6.1 Major reasons for degeneration:

- Shifting of the main channel of Ganga
- Rapid siltation occurring at the off-take of Jalangi River. This prevents the discharge to enter through the course of Jalangi except during the monsoons.
- Sediment Quarrying from the river bank and -dry river bed,
- Land-use changes,
- contamination of river water through the release of effluents into the river, garbage dumping etc.
- The presence of water hyacinth is a common phenomenon in the lower course of the river indicating eutrophication.
- The anthropogenic impact is mostly, visible in the areas near Krishnanagar city.
- In spite of baneful and sometimes overbank discharge during the monsoon season, there is a possibility that the river could turn into an abandoned one in near future. Mitigation measures with proper planning should be implemented to regenerate the river environment.

6.2 Degeneration Scenario:

It was first revealed by Rennell (1781) that these rivers were not usually navigable in the dry season. He stated that the Bhagirathi River was almost dry except monsoon months and Jalangi was non-navigable in some years during two or three months of the dry season, though a stream flowed through it perennially. He also showed that Jalangi was the only navigable river of the region. Stevenson, Moor et al. (1919) revealed that Jalangi was not navigable during the dry season, though previously it used to be navigable during the whole or greater part of the year. For purely navigational purpose, the ruling British Government initiated some measures like dredging to resurge the moribund rivers in the early 19th century with only Jalangi responding positively. It was in favorable condition during late 1820's and was navigable for the medium sized boats throughout the year. In 1831, a devastating flood occurred in the Bhagirathi basin which opened up the Bhagirathi River for navigation. The flood water inundated a major portion of the moribund region and caused a northward shifting-of the Jalangi offtake Rudra, K. (1987):

6.3 Transformation of the upper part of the Jalangi as paleochannel:

The upper course of the Jalangi. River became sluggish after that and it failed to transport the silt which it received from Padma River. The shoaling behind the offtake continued for a long period and as a result the river remained unfavorable during the middle part of the 19th century. Lang (1851) monitored the entrance of the Jalangi from -1821 to 1847 and showed that it had shifted five times during this period in accordance with the shifting of Padma in order to keep itself active. Therefore, since the midway of the 19th century, upper part of the Jalangi is gradually transforming into a paleochannels.

6.4 Nature of Lower Course of the Anjana:

The situation is different in the lower course after the confluence point of Bhairab and Jalangi Rivers. The Bhairab River started to open up in 1874 and during 1880's, it developed into the main entrance channel of Jalangi (Reaks, 1919). Since that time, 'the flow of jalangi is maintained by Bhairab River and the river till now is navigable for the small and mid-sized boats throughout the year. After the meeting point, Jalangi follows a winding path to course through the Nadia district up to its confluence with Bhagirathi near Nabadwip town. The most remarkable feature or this lower course is that 'the meandering curves are well preserved and their variability in different times seems to be minimal.

6.5 Final Observation:

The offtake of the Jalangi River has shifted over different periods with the shifting thalweg of Padma. The original offtake is non-functional now. It is a real challenge to locate the original offtake in the field as well as in the contemporary satellite images. Significant changes in the general health of the channel occurred in the upper course of Jalangi and that part has become a paleochannels during the course of time. The discharge of Bhairab River helps the flow of Jalangi River to continue up to its convergence with Bhagirathi Hugli River. Otherwise, the entire course of Jalangi would have become a paleochannels. During the last century or so, major changes in the morphological character of the lower course of Anjana River could not be traced. The channel width of Jalangi River is decreasing continuously. Flood appears to be a major threat for the region during the monsoon season and a substantial proportion of land remains inundated for a long time if a major flood occurs. But even a high intensity extreme flood event may not bring about long-term changes in the channel morphology of Jalangi. Location and arrangement of the brick fields, occurrence of water hyacinth, usage of river water for sanitation purpose etc. further degrade the health of Anjana River.

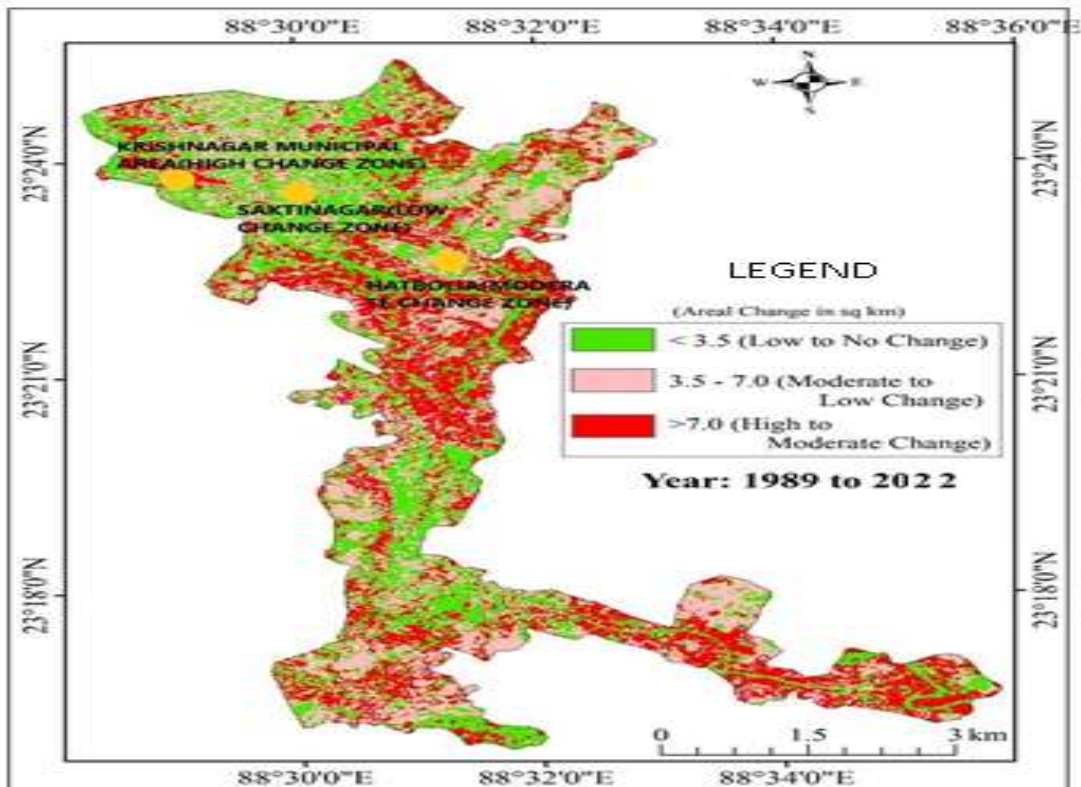


Fig. 2: Final Observation of the Study Area

7. Recommendation:

Once upon a time the river Anjana was a healthy river with its natural ecosystem. But now it is a degraded canal. Anjana contains a healthy ecosystem with a natural biodiversity till now. But if the river dies there will be a huge loss of biodiversity as well as socio-economic crisis.

- Here we mainly selected three study area on the basis of the pollution level. Lastly, we can say that socio economic condition is much better in Krishnagar municipality area because of urbanization on the other hand we can say that economic condition is much lower in Saktinagar and Hatbolia.
- In the perception we can see that people of Saktinagar and Hatbolia has taken some proper steps to avoid degradation of this river. But in municipal area peoples are thrown their garbage in Anjana River.
- Quality of water is much better in Saktinagar area than Krishnagar municipal area. So, there should be no more concrete construction on the bank of the river. Local people need a general awareness. Prevention of garbage throwing in the river is too necessary. Regular observation, dredging, aquatic weed, control widening of the narrow river, pollution control should be performed under the govt. project and also under the local bodies throughout the year. Otherwise, this inhuman attitude will be responsible for the destruction of The River Anjana.

Conclusion:

Anjana River still acts as a necessary component for the people of Nadia district. Human beings carry out different activities depending solely upon this river. From this study, it is revealed that the alterations in the physical landscape are very few in the areas through which the river continues to flow, further evoking the notion of moribund region suggested by Bagchi (1944).

However, gradually the channel is shrinking and the water is getting polluted by different agents. So, even though the discharge through Jalangi is satisfactory during the monsoon season, there is every chance that the river could turn into an abandoned one in the near future. The consequences could be really hazardous and could severely disrupt the eco-systems in the region. The curative measures with proper planning and management could be suggested to regenerate the river environment.

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