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RESEARCH ARTICLE

USE OF GIS TO EVALUATE THE IMPORTANCE OF FLOOD PLAIN FEATURES TO RURAL LAND USE IN BENGAL DELTA PLAIN REGION: A CASE STUDY OF PURBASTHALI I AND II BLOCKS

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ABSTRACT

Flood plain is relatively low lying flat, fertile land adjacent to the river, streams, lakes and estuaries/oceans which is preferable location for human habitation. People try to live in this unique ecosystem in accordance with the ecological principles. The low lying areas are normally filled up by water to form several types of water bodies like pond, lake, bills, marshy lands, ox-bow lakes etc. and provide specific ecological inputs to sustain the ecosystem of floodplain. With the rise of population, more food production requires more lands while the expanding settlement and urban area reduces this resource. These put enormous pressure which leads to destruction of the ecologically sensitive surface water bodies. Remote sensing and GIS has been used to study the land use land cover of the region and specific emphasis was given to identify and map surface water bodies. GIS helps to calculate the water holding capacity of the ponds and revealed that they can support the whole population for domestic and other uses. GIS also used to study the correlation among these features and evaluates the relationship among the geomorphic set up and the human activities. It is seen that some form of destruction has already began and actions must be taken to stop such encroachments of human activities to the environmentally sensitive features for sustainability.

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INTRODUCTION

Flood Plain

Flood plain is relatively low lying flat land adjacent to the river, streams, lakes and estuaries/oceans. Flood plains have gained recognition as vital components of the fluvial ecosystem. It periodically gets inundated for a considerable time of a year and forms several geomorphic features of river erosion and deposition. The periodical inundations along with the depositions form distinctive soil, land use land cover and biodiversity. Flood plains offer the most fertile natural lands and witness the growth the civilisations. The periodic inundation along with the dense human habitation and fertile agricultural lands make the region vulnerable to economic loss. To live with the natural hazards, the land use land covers of the flood plain evolve to their climax stage to minimise the loss of life and properties.

Major issues of Flood Plains

It has already been told that the major characteristics and issue of the flood plain is flooding. The growths of riparian civilisations have reached to new high. The maximum rate of population growth and urbanisation demands more and more agricultural lands for much needed food. At the same time efforts are also made to reduce the flooding events to reduce the loss. So, to get controlled and desired river discharge, several river training measures are taken through the construction of embankments, dams, barrages, river

channelization, bank stabilisation etc. These efforts are altering the nature and characteristics of natural flood plains and giving rise to several environmental, ecological and economic issues. This is to mention that presently most of the flood plains of the world are affected by arsenic poisoning both due to natural and man-made factors [1, 2, 3]. Although the flood plains are suffering from several issues, still they are the most demanded destinations for new settlers, urban growth, industrial set up, infrastructure development and many more.

Importance of Flood Plain Features on Rural Land Use

Rural areas of India is characterised by highest percentage of agricultural activities along with the low population density. The agricultural activities demand huge amount of water. From the ancient time, rivers and other natural water bodies supplied the much needed water for agriculture along with domestic needs also. Water front settlements are the normal land use land cover of any flood plains of India. We do believe that the rural land use has evolved in accordance with the natural flood plain features. The low lying areas other than bills, marshy lands, ox-bow lakes are occupied mostly by agricultural and other low cost land use land cover while the relatively higher grounds are occupied by rural settlements and other relatively high value land use land covers. Major roads and railway lines are generally developed on natural levees. But the preset rate of population growth and urbanisation often seen to ignore the norms of the nature and developments are done as per the need of the society. As a result different conflicting issues are being experienced in the flood plain regions.

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Need of the Present Study

The Bengal Delta Plain Region is located on the active flood plain developed by the river Ganga-Brahmaputra. The region is extended over India and Bangladesh. It has witness the growth of Indian Civilisation. From the ancient time, the civilisation has grown much and Kolkata (Formerly Calcutta) is one of the oldest cities situated in this region. To keep the normal growth and development of the Indian part of the delta region, one important river training structure, Frakka Barrage is completed and inaugurated in November, 1987. The huge population growth requires more food to grow while increasing city and settlement size and infrastructural development reducing the available lands for cultivation. Pressures are felt on land use land covers other than agriculture and settlement which are seen to reduce their size day by day. This is believed that presently settlement and other high value land use land covers are also being developed on the low lying lands as the river training structures are meant to reduce the risk of flood damages. The active flood plain features like bills, marshy lands, ox-bow lakes are being converted to agricultural lands even to settlements also. Need has been felt to reassess the basic pattern of land use land cover of the active Bengal Flood Plain regions and how the flood plain features are influencing them. Studies are needed to assess the potential risk of such growth.

The active flood plain is extended to some portions at the eastern part of the Ganga-Bhagirathi River. The eastern part of the Burdwan District is located in this active flood plain region. The district Burdwan is one of the best agricultural region of India and with the active flood plain features, fertile lands, the eastern part become the most important agricultural regions of the Bengal Delta Plain. Similarly, this part has witness tremendous population growth in the recent past and so the natural norms of settlement and other land use land cover may have altered in this part. With the advancement of the other research tools and techniques, remote sensing and GIS has come to a major help in modernising the geographic and other research. The GIS with the availability of high resolution satellite images can help to map exact features and the close association and inter-linkages of several components of land use land cover and geomorphic features.

2. Description of Study Area

The present study area is located in the eastern part of the district Burdwan of West Bengal (Figure: 1). It is a monotonous alluvial plain with relief in the range of 10–21 m. A.S.L. Various levees, active / abandoned channels, cut-off meander loops, ox-bow lakes, back swamps and inter-levee depressions / flood basins –mostly aggraded – are common.

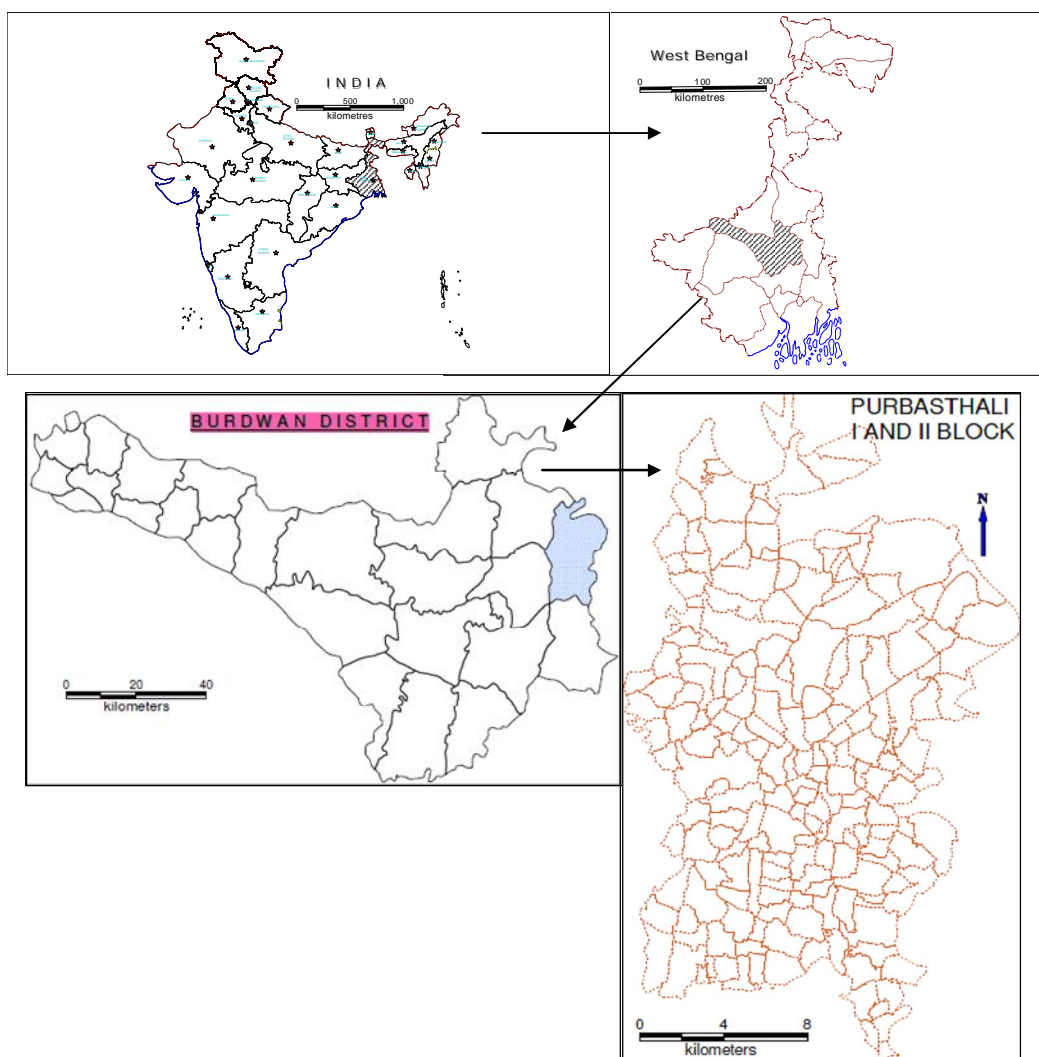


Fig. 1. Location Map of the Study area

The river Bhagirathi-Ganga forms the eastern border of the block. The other active channels are Banka, Faria, Brahmani, Khari, Gurjani etc. traversing the Purbasthali Block from west and meet the Bhagirathi River in the east. The general slope is from north to south and southeast. The present landscape evolved from the shifting of channels, which align primarily north to south, with convexity towards the east. This part of the region has one of the oldest cities Nabadwip which was the Capital of Ballal Sen and later Lakshman Sen during 1159 – 1206. Since then the city and the region has got a huge change in its shape and size and also changes are observed due to modern development of infrastructures. The changes are seen all over the region. The present study would like to investigate the association of the present land use land cover of the region with the geomorphic features of the region. The study will intensively use remote sensing and GIS along with other conventional tools and techniques.

3. Land use land cover of the region

General land use land cover of the region has been identified primarily with the help of Survey of India (SoI) topographical sheet, surveyed in 1974 and it has been updated by the IRS-1C, LISS-III (2000) and Google Earth Image (2010; Figure:2). Major forms of land use land covers of the region are agricultural land, settlement and communication, and surface water body. It has been very difficult to differentiate the rural settlement from orchards using digital image processing, so visual image processing technique has been used to identify different forms of land use land cover of the region. QGIS software (v 1.7.4) has been used intensively for the map making and data generation.

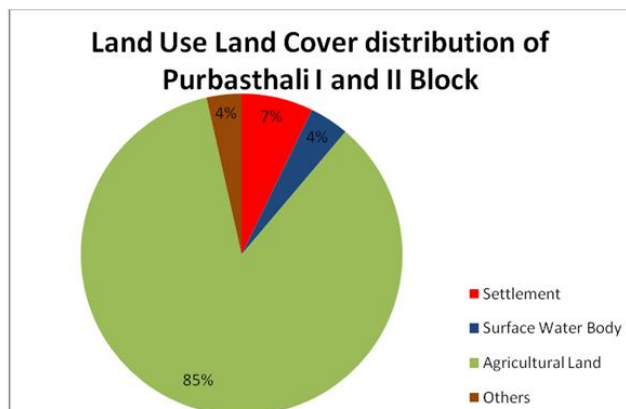


Figure: 2 Land Use Land Cover distribution of Purbasthali I and II Block, 2010

Agricultural land use land cover

About 85 per cent of the total area of the Block is being used for agricultural activities and the lands are mostly irrigated land. The agricultural activities are occupied in different relief zone of the low lying flood plain of Bhagirathi-Hoogly River of the Burdwan District of West Bengal. The main varieties of crops are rice and jute.

Settlement

The region covers settlement from very old historical periods and presently about 7 per cent of the total land of the Block is occupied by settlement. Mostly the settlement is distributed in the higher relief zone of the Block and important transport and

communication lines of the regions also running over the higher relief zones.

Surface Water Body

Surface water bodies are distributed all over the region and mostly developed by the horizontal movement or oscillation of the river Bhagirathi-Hoogly. The oscillation of the river leaves meander scrolls, ox-bow lakes, scar and many other depressions which hold water for sufficient time of the year and provide very important water for irrigation and domestic use also. Origin and distribution of surface water bodies are discussed in details in the following section.

4. Geomorphic setup of the region

The geomorphic set up of the region is studied with the help of SRTM (Shuttle Radar Topography Mission) data. SRTM data provides elevation data on a near-global scale to generate the most complete high-resolution digital topographic database of Earth. The data has been processed using QGIS software (1.7.4).

SRTM data and generation of 1 m contour

The SRTM data has been downloaded from the following web site <http://srtm.csi.cgiar.org/>. The subset of Purbasthali I and II Block has been done using the 'clipper' sub-menu of the 'Raster' menu of QGIS. The outer boundary layer of the Purbasthali I and II Block is used for 'masking'. One meter 'contour' is 'Extracted' from the 'Raster' menu of the QGIS.

DEM Map

A DEM is a computerized representation of the Earth's terrain [4], and can be described by a wire frame model or an image matrix in which the value of each pixel is associated with a specific topographic height [5]. DEM represents the Earth's surface elevation at a range and its use ranges from military terrain analysis through earth science and engineering practices. DEM is capable of morphometric quantification of ground surface relief and patterns [5, 6, 7, 8, 9]. A DEM of the Purbasthali I and II block has been generated and different relief zones are classified (Table: 1 & Figure: 3) From the Table 1 we can see that about 64 per cent area of the total Block is below 14 meter of relief (AMSL). Surface elevation of the main water body, the river Bhagirathi-Hoogly is about 10 meter. The Block has 37 per cent of its total area under 12 meter of relief. Very little, less than 2%, area of the block is above 20 meter of relief. This is to point out that the higher relief zone is located in the central part of the block and it contains the oldest settlement zone. Some old and abandoned channels of the river Bhagirathi-Hoogly are also seen in this zone. The linear pattern of the higher relief, running in an oscillating pattern from north-west to south-east of the block clearly indicates the oldest levee deposition in the area.

Geomorphic Map

A geomorphic map (Figure: 4) has been prepared. The Purbasthali Block is full of flood plain geomorphic features. The important geomorphic features identified are the river channel, point bar deposition, mid channel bar deposition, meander cut-off, bills, dry parts of bills, ponds, ox-bow lakes, dry channel, paleo channel, mender scroll, accretion surface, abandoned meander bar, active flood plain and older alluvium.

The central part of the region is having the most important and complex geomorphic features. The active river channel and meander cut-off and several other features are present in this part. There is clear divide of active flood plain and older alluvium of the block. The eastern part of the block is the 'active flood plain' and the western part is the 'older part'. In the western part one of the important tributaries of the Bhagirathi-Hoogly is flowing over this region. The block is enriched by numerous surface water bodies. The natures of these surface water bodies are having different geomorphic importance. Close observation of the surface water bodies reveals meandering pattern and indicates the riverine origin of these surface water bodies.

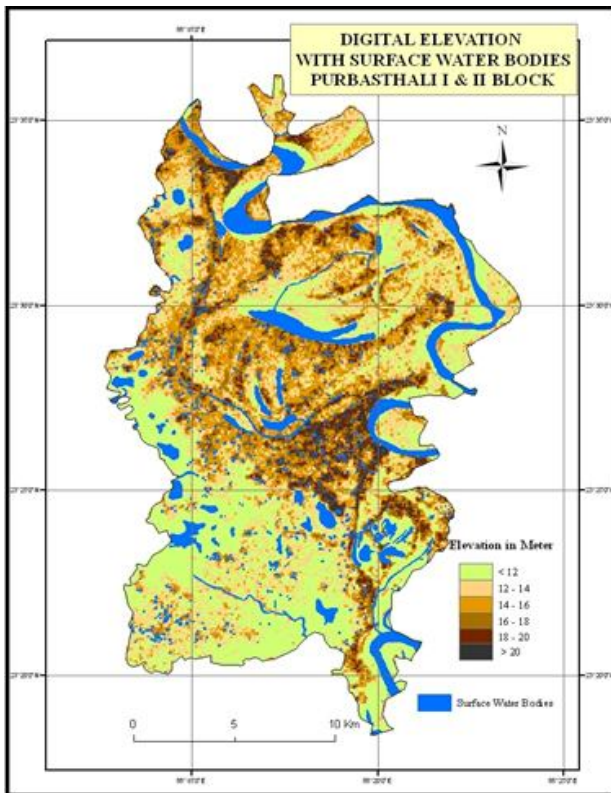


Figure: 3 Surface Water Bodies Superimposed on Digital Elevation Map Generated Using SRTM Data

Drainage map superimposed on the SRTM based DEM map

Surface drainage or water bodies are superimposed over the DEM map of Purbasthali I and II Block (Figure: 3). It is expected that there shall be close link and association of the distribution of the surface water bodies and the relief of the block. But the surface water bodies not only occupying the low lying areas of the block, but they are also distributed to all the relief zones of the block. This point is further discussed below.

5. Surface water bodies as important feature of flood plain

The topographic depressions on the Earth's land surface which hold running or stagnant water for a considerable period of time of a year can be designated as surface water bodies. The surface water bodies of the flood plain are the most important features in terms of geomorphology, economic, social and ecology and environment. The flood plain is characterised by frequent inundation, sediment deposition, lateral movement of the rivers and erosion. As a result, rivers always leave their

imprints on the surface as marshy lands, bills, ox-bow lakes, meander scars, inter-levée depressions. These features and the river itself hold water on the Earth's surface for a considerable time in the year. The important environmental and geographic importance of the surface water bodies can be:-

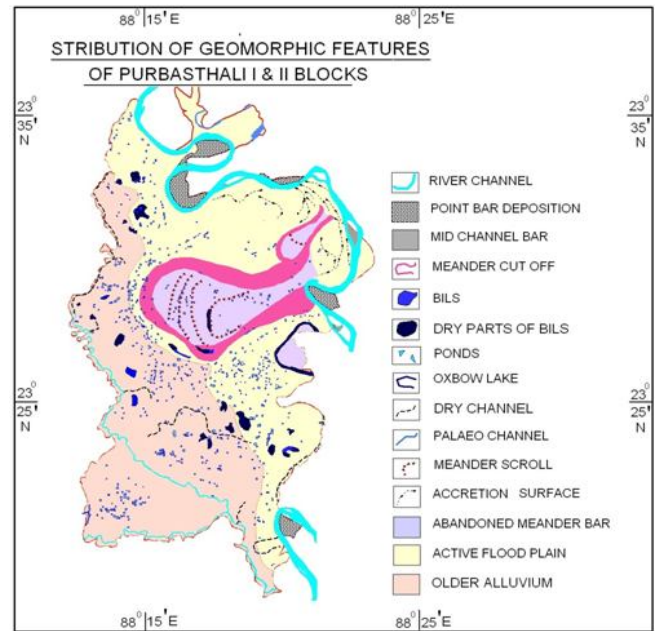


Figure: 4 Geomorphic Features of Purbasthali I and II Block

Provide flood storage: The surface water bodies are very useful to store a considerable amount of excess rain water and lower the flood peak and reduce the velocities for downstream lands.

Reduce wave damage: The surface water bodies are mostly surrounded by good amount of natural vegetation and plays vital role in reducing the force of flood discharge which in turn helps to reduce flood damages. It also helps to moderate erosion by reducing water velocities, binding soil and contribute to the stability of stream channels.

Reduce sediment loadings in streams: The wetlands often reduce the sediment flowing into the river by intercepting and trapping sediment within it.

Provide groundwater recharge: The flood plains are often consists of fine clay and has very poor porosity and so the percolating water takes more time to recharge of the ground water. The surface water bodies help to recharge the ground water by holding the water for a considerably long time of the year. Similarly at the drier periods of time the water of the depressions provide groundwater discharge which helps to maintain the base flow of streams.

Prevent pollution from entering water body: The surface water bodies and other wetlands not only intercept sediments but they also intercept nutrients, debris, chemicals etc. and prevent them to reach to the main water bodies like rivers, streams, lakes, estuaries, oceans and ground waters.

Provide habitat for fish: The surface water bodies are perfect place for fish cultivation. Variety types of fishes are cultivated in the depressions and provide valuable food supplement to the local people. As like fish, they also support a rich biodiversity

of amphibians, reptiles, mammals, and insect species. Some of the bills of the preset study area provide habitat for migratory birds also.

6. Different forms of water bodies in the study Area and their mode of origin

The surface water bodies of the Purbasthali I and II Blocks are identified and mapped using SoI Topographical Sheet (1974), IRS-1C Satellite Image (2000) and Google Earth Image (2010). (Figure: 5). The identified surface water bodies are discussed below.

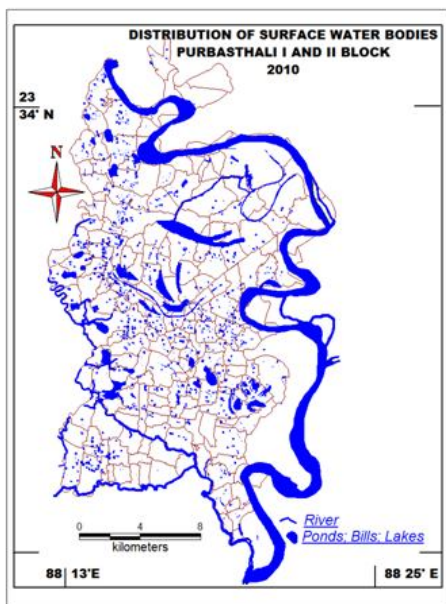


Figure: 5 Surface Water Bodies of Purbasthali I and II Block

The River Channel

The river Bhagirathi-Hoogly formed the north and eastern border of the block and flowing from the north to south direction. There are some other rivers which are flowing from western part to meet Bhagirathi in the east. Other active channels are Banka, Faria, Brahmani, Khari, Gurjani etc. The rivers pass through 52 villages, i.e. 27 per cent of the total villages of the blocks. Total population living in these villages is 70318(2001) i.e. about 21 per cent of total population of the blocks. Almost all the rivers of the region are sinuous to meandering.

Table: 1 Relief Zone of the Block Purbasthali I and II

AVERAGE RELIEF OF SETTLEMENT OF PURBASTHALI I AND II BLOCK		
Relief (m)	Area (Hect.)	% Area to Total Area
> 20	6.56	1.90
18 - - 20	18.31	5.30
16 - - 18	30.09	8.71
14 - - 16	70.94	20.54
12 - - 14	91.74	26.56
< 12	127.8	37.00
Total	345.4	100.00

Source: Author's Calculation

The sinuosity index ranges from 1.30 to 1.95 (Table: 2). It can be interpreted that the rivers are travelling more distance than

the air distance. This would signify that the region have enough flowing surface water resources. All of the rivers are perennial and navigable throughout the year.

Table 2. Channel Pattern of Major Rivers of Purbasthali

Name of the Rivers flowing through the Blocks	Total Length (km)	Sinuosity Index (Leopold, et. al. 1957)	Category
Bhagirathi-Hoogly	70.62	1.95	Meandering
Banka	13.18	1.41	Sinuuous
Brahmani	11.62	1.30	Sinuuous
Khari	35.38	1.46	Sinuuous

Source: Author's Calculation

Ox-bow Lakes; Meander Scrolls and Sloughs

The ox-bow lake, meander scrolls and sloughs represent the cut-off portion of meanders, depressions and rises. Areas of dead water formed both in meander-scroll depressions are identified as surface water bodies (Figure: 5). The Table: 2 reveals that the rivers of the region are sinuous to meandering in pattern, this signifies that the rivers are having horizontal movements on the surface and in the process they leave the imprints on the surface as meander scroll, sloughs and finally leaves ox-bow lakes as a major features on the earth's surface. The Purbasthali I and II Block is having numerous ponds as surface water bodies. Close look at those features would surely reveal the linear and oscillating pattern of the ponds. The field studies reveal that the demand for land and partition of the lakes as personal property converted the ox-bow lakes or meander scrolls as individual ponds in the region. In conclusion we can say that almost all the surface water bodies are fluvial origin and the horizontal movements of the main rivers of the region leaves these water bodies on the earth's surface.

7. Distribution of Surface water bodies

% of Village Area Under Surface Water Bodies

In general about 5 per cent area to total area of the Block is covered by the standing surface water bodies. The figure no. 6 and the table no. 3 shows that there are two villages where the surface water bodies cover >30 per cent of their total area of the village. The village, J.L. No. 142 has about 89 per cent of its total area under surface water body. About 17 % of the total villages have no such important standing water as lakes or ponds. But they are having perennial rivers. River Bhagirathi is one of them. The rivers are meandering or sinuous, so they travel at least 1.5 times more distance than the air distance of the rivers inside the villages. About 6 per cent of the total villages do not have significantly large water bodies. Among these villages, some of them are uninhabited village and less than 4 per cent of the total population are living there. The absence of large significant water bodies may not have any important negative implication to the livelihood to the local people. About 15 per cent of the total villages have >10 per cent of their total area under surface water bodies. They contain about 17 per cent of total population of the Blocks. All most all the water bodies contain water throughout the year. Many of the ponds even are connected by some narrow links with the main rivers. So, availability of surface water is not a problem in the region.

Calculation of Water Holding Capacity of the Surface Water Bodies

The GIS analysis revealed one of the important locational characteristics that the settlements of Purbasthali I & II Blocks

are mainly water front location. About 62 per cent of total settlements are located at the water front. These villages contain about 53 per cent of the total population of the Blocks. These 62 per cent villages contain about 60 per cent of the total available surface water bodies of the region. The depth of the surface water bodies varies spatially and as well as temporally. During the field visit it has been learnt that even in the driest months, the most of the surface water bodies contain more than 2 meter of depth. Considering the average annual depth of 2 meter, the surface water bodies of this particular category can hold about 5600000 Gallon of water. While the annual water demand for the villagers (40 Litters/Day) will be 1900000 Gallon. So, after meeting the domestic demand there will be about 3700000 Gallon of excess water in the region, which can be used for other purpose (Table: 4).

Table: 3 Area under Surface Water Bodies

% of Area under Water Body	% to Total Village
0	16.84
0 – 5	52.11
5 – 10	15.79
10 – 20	12.63
20 – 30	1.58
>30	1.05

Source: Author's Calculation

8. Intensive study of individual flood plain features and their probable importance on the land use

Surface Water Body

The environmental and geographic importance of the surface water bodies are already discussed in the previous section. The available literatures and field investigations indicate that the surface water bodies, especially the ponds, lakes are very important features in the daily life to the local people and at the same time it has great influence on many economic activities of the region.

Irrigation

Irrigation is the most fundamental and important form of use of the water from the surface water bodies. The available literatures suggest that the efficiency of irrigation is low (not more than 30-40%) in this region and as well as to India also. This is due to inappropriate field channels, inadequate preparation of land and lack of consolidation of land holdings. Field investigations revealed that the marginal and small farmers have 70% of their lands irrigated by small tanks and stored rain water.

Table: 4 Surface Water Bodies, Water Holding Capacity and Demand

% of No. of Settlement to Total	Population (%) in the Villages	% Surface Water Bodies	Water holding Capacity Gallon (00000)	Water Demand Gallon (00000)	Difference between Water Available & Demand (00000)
62.30	53.06	59.82	55.55	18.90	36.66
2.19	1.31	2.28	2.12	0.47	1.65
2.19	3.00	3.47	3.23	1.07	2.16
3.28	2.46	3.88	3.60	0.88	2.72
12.02	12.34	9.08	8.43	4.39	4.04
18.03	27.83	21.46	19.93	9.91	10.02

Source: Author's Calculation

Table: 5 Percentage Distribution of Land Use Land Cover over Relief Zones

Relief Zone (Meter)	Settlement (%)	Surface Water Body (%)	Agricultural Land(%)	Others(%)
< 12	4.27	1.48	93.75	0.50
12 - - 14	6.00	4.34	88.61	1.05
14 - - 16	5.23	3.65	89.72	1.40
16 - - 18	9.07	4.47	84.46	2.00
18 - - 20	10.21	6.60	79.95	3.24
>20	8.46	3.28	75.30	12.96

Source: Author's Calculation

Domestic

Water is life and 53% of the total population of Purbasthali I and II Block are living at the water front location. This indicates the importance of water body in daily life of the rural population of the region. The people of the region use the surface water body for every domestic use like bathing, washing and cleaning. The region is affected by arsenic pollution. Some water treatment plants are there to use the surface water bodies for domestic supply of the water. Beside the domestic use, the surface water bodies are integral part of the religious and other social customs. The surface water bodies are used for activities and rituals like marriage, birth, death, worship, idol emersion and many others social activities.

Others

The present region is very important jute cultivating region of West Bengal. Some of the surface water bodies are used for jute decomposing. Without sufficient number of surface water bodies, the jute cultivation would have not been possible in the region. Some of the water bodies of Purbasthali I and II Block are so big that they are being used for transportation also.

Levee

Levee is an elevated, wedge-shaped, sedimentary form deposited where floodwater slows as it moves from the channel to the floodplain. It consists of fine sand, silt and/or clay, and can vary in height and cross section and in its lateral continuity. It is the highest part of the flood plain and located adjacent to the main rivers. Levee is the most important flood plain feature and very useful to prevent frequent flooding as it restricts water to overflow. Levee is useful also for some specific land use land cover.

Major Communication Lines

One of the major transport and communication lines in the area is the Eastern Railway Lines from Howrah-Bandel to Barhawa via Katwa (Bandel Barharwa Line). The rail line is mostly following the natural levee and in some pockets it is artificially elevated.

Settlement

The settlement pattern of flood plain is normally agglomerated. Some of the linear form settlements are there along the major communication lines.

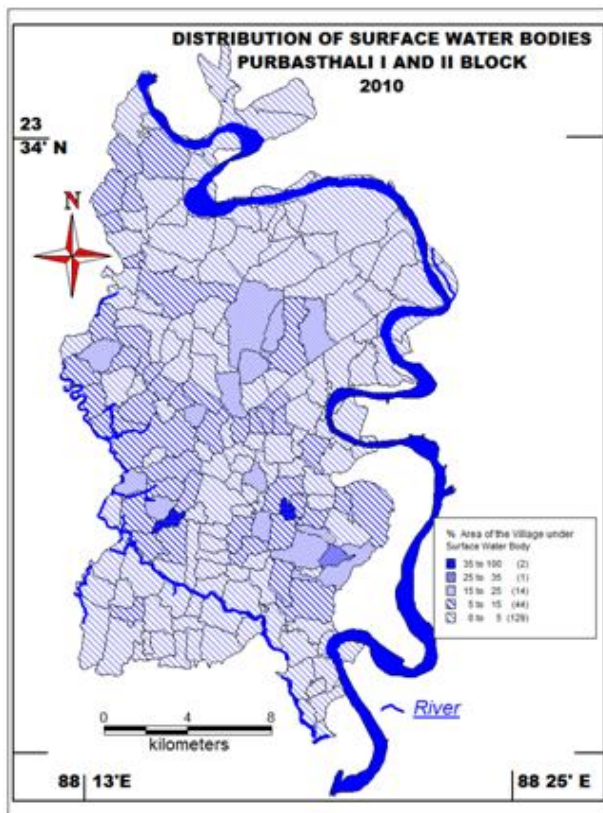


Figure: 6 Percentage of Surface Water Bodies to the total area of the respective village of Purbasthali I and II Block

As the flood plains are subjected to frequent inundation, it is normal to observe that the settlements shall be on the higher grounds. The higher grounds may be natural or artificial levees, ridges and some flood deposits. The extracted contours are superimposed over the settlement layer using QGIS and average altitude of the settlements are calculated and mapped (Figure: 7). It is seen from the *Table No. 5* that about 55 per cent of the total settlement of the Purbasthali I and II Block is located in the relief zone of less than 14 meters. And less than 8 per cent of the total settlement is located in the low relief zone of less than 12 meter. About 90 per cent of the total settlement is located in the relief zone of 12 to 18 meter and very little settlement are located in the highest relief zone of greater than 20 meter of relief.

It is expected and can easily be hypothesised that the low relief zone should be susceptible to flood and the people should try to avoid the low land for settlement and habitation. It is seen from the table that '*Low Relief Zone*' i.e. less than 14 meter relief zone occupies about 64 per cent area of the total Block but contains about 22 percent of the total habitation and 28 percent of the total population of the Block. The important land use land cover of this zone is agricultural activities. About 94% of the land area below 12 meter relief zone is occupied by agricultural activities. It is very interesting to note that the agricultural land use coverage is decreasing with increasing relief zone (Figure: 8). It can easily be understood that the higher relief zone should be occupied by the settlement, transport and communication and other high value land use land cover. In the low relief zone the settlement coverage is very negligible, only about 4 per cent. The '*Intermediate Relief Zone*' i.e. relief between 14 to 18 meter contains about 30 per cent of the total area of the block and contains about 45 per cent of the total population of the Block. This zone is seen with

gradual increase in settlement and others land use land cover; and decrease in agricultural coverage. The highest percentage of settlement, 10.21%, is covered in the relief zone of 18 to 20 meter. The '*High Relief Zone*' i.e. more than 20 meter relief zone contains less than 7 per cent of the total area and also holds less than 5 per cent of the total population. This zone mainly covered by others land use land cover i.e. transport and communication of the region. The agricultural coverage is little above 75 per cent which is least in this high relief zone,

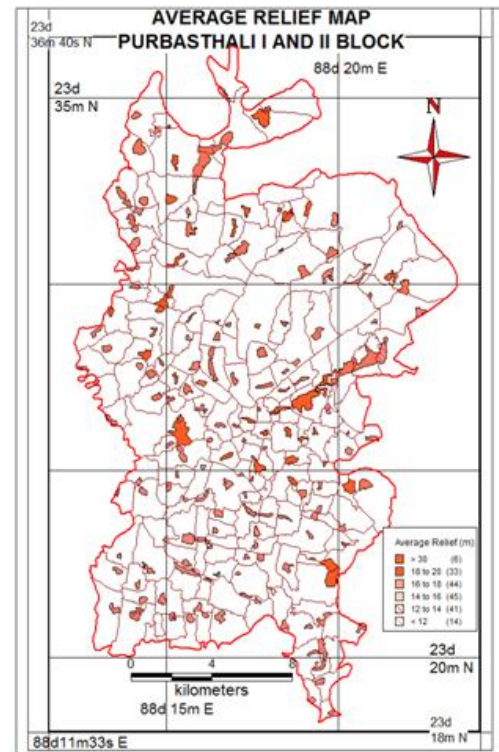


Figure: 7 Average altitude of the Settlement of Purbasthali I and II Block

Low lying Plain Areas

From the above discussion we understand that the low lying plain areas are lying below 14 meter relief zone in this particular area. About 64 per cent of the total area of the Block is lying with in this zone.

Agricultural Lands

We can expect the low relief zone should be covered mainly by the water bodies and agricultural lands. The low relief zone has further been divided into two zones i.e. less than 12 meter and 12 to 14 meter relief zone. In the lowest we find that about 94 per cent of its total covered area is under agricultural activities. And the second category has about 89 per cent of its total area under agricultural activities.

Orchards/Forest

From the satellite image and the official statistics we can find no forest covered land and the orchards are associated with the settlement and it is very difficult to distinguish it from the settlement area.

9. Conclusion

The narrow low lying relatively flat, fertile land adjacent to the river, streams, lakes and estuaries/oceans is

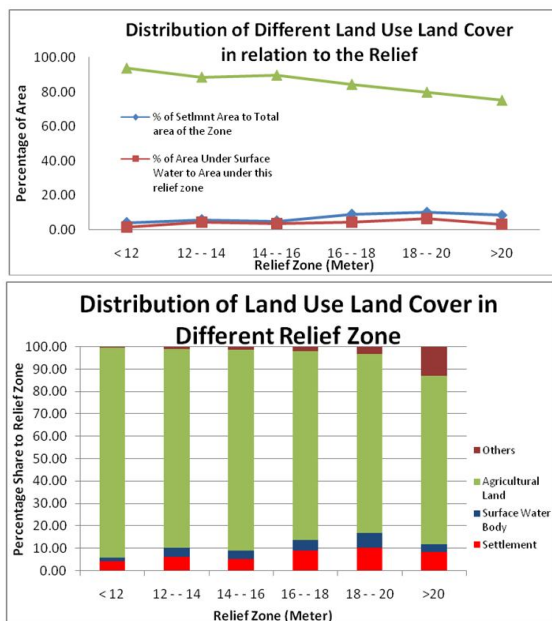


Figure 8. Distribution of Land Use Land Cover over Different Relief Zone, 2010

known as flood plain and they are subjected to many issues like frequent flooding. But this geomorphic unit has always been preferred for human habitation i.e. establishment of civilisation. People try to live in this unique ecosystem in accordance with the ecological principles and issues. The present study has been conducted in the western part of the Bhagirathi-Jalangi confluence, the Purbasthali I and II Block of Burdwan District, West Bengal. Land use land cover of the regions is dominated by agricultural activities which covers about 85 per cent of the total area of the Block. The other dominant form of LULC is surface water bodies and settlement & communication. The land use land cover of the region has been evaluated using remote sensing and GIS. Topographical sheet of 1974, IRS-LISS-III satellite image of 2000 and Google Earth Image of 2010 has been employed to evaluate the LULC, geomorphic setup, identification and mapping of the ecologically sensitive surface water bodies and several other aspects. Intensive use of GIS has been done to establish the relationship among the different aspects of the geomorphic setup and the human interaction with them. GIS has also been employed to evaluate the water holding capacity of the surface water bodies. It has been calculated that even in the drier months the surface water bodies can hold 5600000 Gallon of water while the annual water demand for rural domestic use is only 1900000 Gallons of water. We know that the region is contaminated with arsenic in ground water, so surface water

use may be the only alternative to manage the issue. Various other geomorphic units are there like levee which forms the higher ground in the region. The higher geomorphic features are being used for human settlements & communication. The low lying areas are mainly occupied by agricultural lands and surface water bodies. Some settlements are also seen in this zone. The field investigations reveal that they are recent origin. As the flood plains are subject to regular inundation, efforts should be made to avoid such encroachment of the human settlement to the low lying areas to minimise the flood loss.

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