

# Social Dimension of Hazard Management

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Section 7  
**Management Options**

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## Hazard Management: A Case Study of Flood Affected Areas in Patashpur-I Block, Purba Medinipur District, West Bengal, India Using Geoinformatics

Jatisankar Bandyopadhyay<sup>1</sup>, Kartic Bera<sup>2</sup> and Nirupam Acharya<sup>3</sup>

**Abstract :** Flood management planning under hazard management helps to rescue the flood affected people, to mitigate the socioeconomic problems of flood affected area and to take necessary preventive measures. It is a planned and integrated management approach with the help of Remote sensing & GIS and data on socio economic characteristics to render right suggestions to the decision makers to provide with food, shelter, drinking water etc.

The study describes an efficient and scientific approach with suitable illustrations of map and real time flood inundations, delineated from satellite images through digital technique. Besides, the land use-land cover classification is also done to show the association of land inundated area with respect to the land use /land covers classes. The study also highlights the application of satellite images to assess the damage caused by flood.

### Introduction

Floods are the most recurring, widespread and disastrous natural hazard resulting in serious social, economic and environment losses in both developing and developed nations. With some of the world's most intense rainfall, dynamic landforms, and high population density, developing countries in general and the countries of South Asia, in particular, are more vulnerable to flood hazards. In recent times, flooding has claimed more lives than any other natural disaster in these areas. India is one

<sup>1</sup> Assistant Professor, Department of Remote Sensing & GIS, Vidyasagar University, Midnapore-720102, West Bengal, India. Email: jatib@mail.vidyasagar.ac.in Cell Phone No-09433455107 Office Tel. No: 03222276554/555/557/558, Ext. 488 Fax: 03222275329.

<sup>2</sup> Research Scholar, Department of Remote Sensing & GIS, Vidyasagar University Paschim Medinipur, Midnapore-721102, West Bengal, India Mobile No-09804703804, E-Mail: ikbrsgis@gmail.com

<sup>3</sup> Student, Department of Remote Sensing & GIS, Vidyasagar University Paschim Medinipur, Midnapore-721102, West Bengal, India. Mobile -09733104400 Email: rsgis.nirupam@gmail.com

of such countries that have been seriously affected by floods on multiple occasions. On an average about 32 million people are affected by floods every year in India (Kale, 1998). Although monsoon rains and floods are welcome because they provide water for crops and other purposes, replenish nutrients in the soils, and recharge the aquifers, the heavy precipitation, however and attendant large floods have a very detrimental effect on the population destroying crops, property and in several cases by taking lives. Patashpur -I block is the most flood affected area of Purba Medinipur district in the state of West Bengal, India. The main problems faced during the monsoon in this area are flooding, drainage congestion and bank erosion.

A relatively high flow in a river, marked by higher than the usual, causing inundation of low land or a body of water, rising, swelling and overflowing land not



Figure 1. Patashpur-I Block in the district of Purba Medinipur

human and cattle lives in Patashpur-1 block (Jana, 2009). These floods are due to over spilling of river bank which is due to heavy rainfall, congestion of canals and basins, slow run-off combined with inadequate channels capacity (Islam & Sado, 2000). These floods are mainly occurring at the south west monsoon period spread from June to September. Patashpur-1 block is mainly affected by Keleghai river. Occurrences of flood in large area of about 17226 hect. Comprise 9 Panchayats and 140 villages.

The need for flood inundation mapping as well as flood plain zoning is most essential for economic development, land resource, communication system and environmental management (Maidment, 1995).

**Aim:** Flood management planning of the study area.

### Objective:

The objectives of flood management planning are,

- Delineation of flood inundated area.
- To suggest plans for moderation of flood.
- To highlight the rehabilitation of flood affected people of the study area.
- To plan for sustainable agriculture.
- To develop a commuting system during flood.

### Study Area:

Patashpur-1 block (fig-1), in the District of Purba Medinipur District in West Bengal, India, lies between  $21^{\circ} 58' 33.66''$  to  $22^{\circ} 6' 34.64''$  north latitude and  $87^{\circ} 27' 8.59''$  to  $87^{\circ} 41' 1.84''$  east longitudes. The study area has mainly one river Keleghai which originates at Barninigram, near Dudhkundi, under Sankrail police station in Jhargram, subdivision of Paschim Medinipur district in the Indian state of W.B. It flows past Keshiary, Narayngarh, Sabang and Patashpur to join the Kasai at Tangrakhali under Mahisadal police station of Purba Medinipur district. The combined stream is called Haldi. It is 121 km (75 mile) long. The steep slope of the river in Guptamani and Sankrail causes floods.

The study area has tropical monsoon climate, mean annual rainfall ranges between 250 to 300 cm. which is concentrated in the months of June-September and the mean annual temperature is  $26^{\circ}\text{C}$ . The soil properties and hydrology condition are quite suitable for agriculture. The geographical area of Patashpur-1 block is  $172.23 \text{ km}^2$  and has 9 Gram Panchayats, 140 Mouzas, 149 inhabited villages and 33470 number of households.

### Geology:

Fig-3 is showing the general geology of lithological units of the Patashpur-1 block

Data Used	Source
Satellite image	NRSC, Hyderabad.
SRTM image	www.gicf.umaic.edu
Toposheet	Survey of India
Geological map	Geological survey of India
Rainfall data	Agriculture dept. (Block seed farm, Patashpur)
Physical, socio economic, relief & other information at the flood time	B.D.O Office (Patashpur-I) and local people

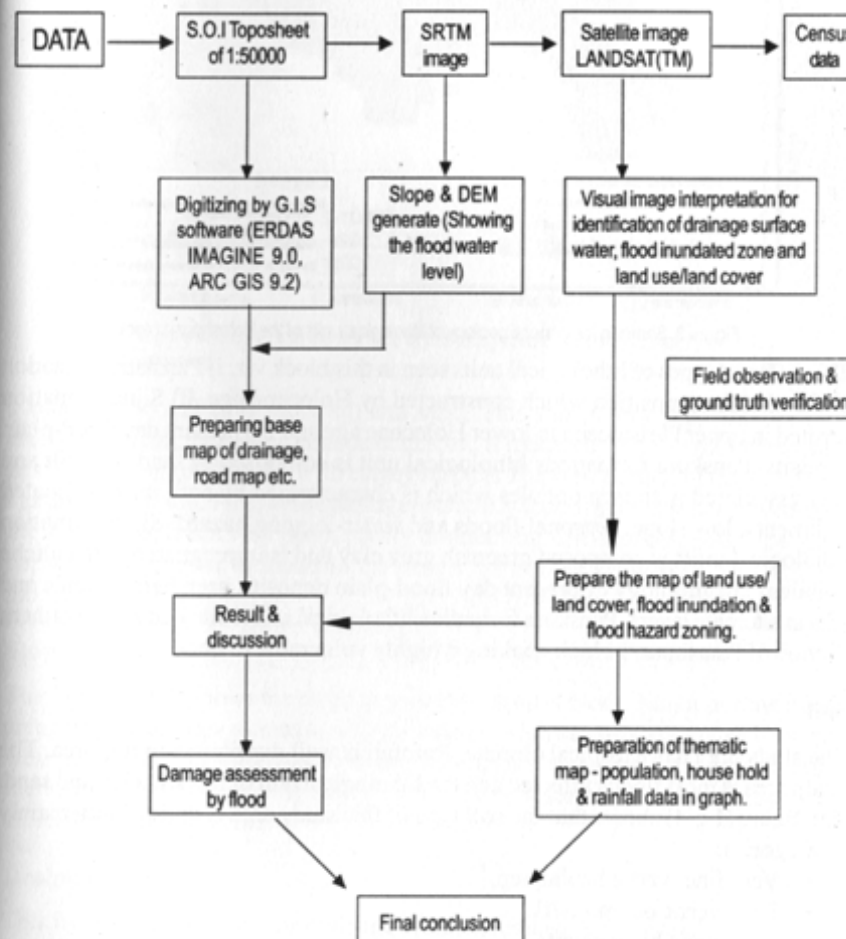


Figure 2. Approach methodology for the work

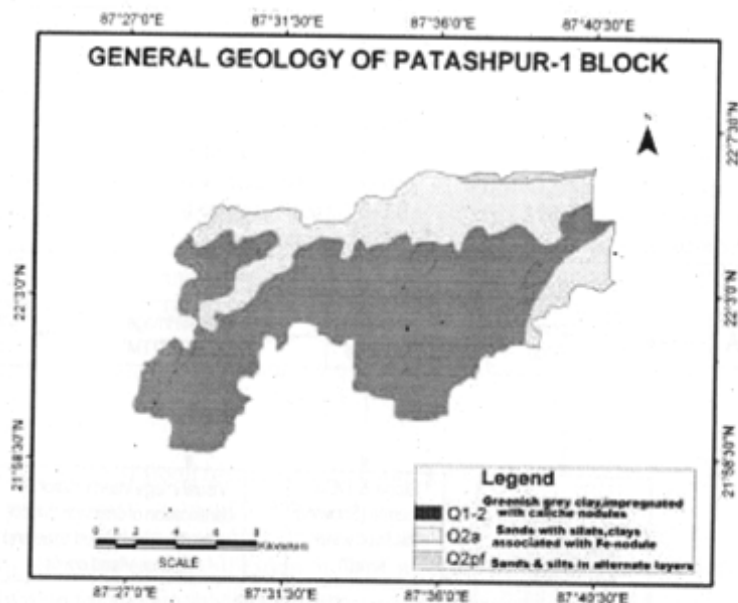


Figure 3. Showing the general geology of lithological units of the Patashpur-1 block.

The different types of lithological units seen in this block viz. i) Panskura formation of flood plain deposition which constructed by Holocene age. ii) Sijua formation formed in upper Pleistocene to lower Holocene age and iii) present day flood-plain deposits. Panskura formations lithological unit is composed of sand with silt and clay associated with iron nodules which is characterized by soft, unconsolidated sediments, low slope, seasonal floods and water-logging hazard. Sijua formation lithological units is composed greenish grey clay and is impregnated with caliche nodules. The lithology of present day flood-plain deposits, seen here is sands and silts in alternate layers. Panskura formation lithological unit is situated at the northern portion of Patashpur-1 block, making it highly vulnerable to flood.

### Soil

The study area has a tropical climate. Rainfall is well distributed in this area. The study area is most floods affected and the lithological unit of it is silt, clay and sand. The figure (fig-4) shows that the soil type of this study area is divided into mainly 4 categories:

- Very fine, vertic haplaquep.
- Fine, vertic ochraqualfs.
- Fine vertic haplaquepts.
- Fine typic haplaquepts.

Very fine vertic haplaquepts soil is found in most of the areas of this Patashpur-

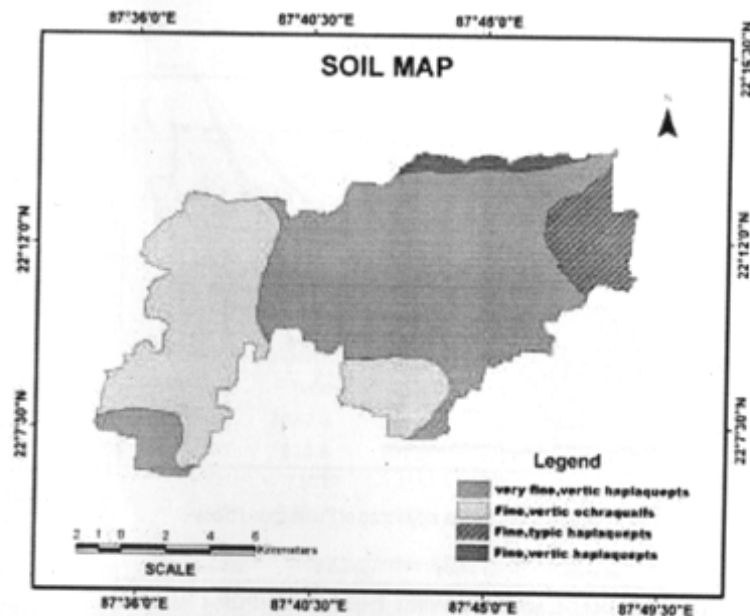


Figure 4. Shows that the soil type of this study area is divided into mainly 4 categories

1 block. Thee soil have more silt and sand. This soil is very deep and not well drained. The cultivation and erosion of this soil is moderate. Fine, vertic ochraqualfs has low lying alluvial plains with clayey surface. The west portion of the study area has this kind of soil. Fine, vertic haplaquepts soil is found in the east north portion of the study area. It is a very deep, poorly drained and fine cracking soil. Fine typic haplaquepts type soil is found in the eastern part of the study area. This soil has moderate salinity.

### Slope

The figure (fig-5) shows the slope map of Patashpur- I block. Major portion of the area ranges from low to medium slope pattern. High slopes are situated in north-west portion and in some places of southern area. Patashpur- I block falls under the lower catchment area of Keleghai. So the low slope areas are mostly flood affected in monsoon time.

### Drainage:

This figure (Fig-6) shows the drainage system of Patashpur-1 block. The Keleghai River is situated in the upper portion of the Patashpur-1 block. The Keleghai River



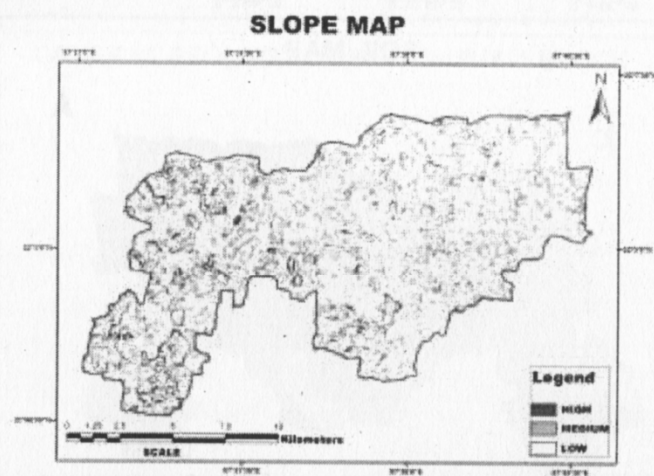


Figure 5. Shows the slope map of Patashpur-I block

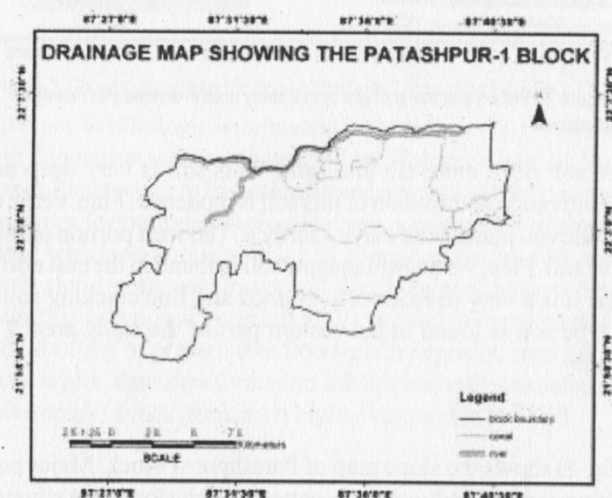


Figure 6. Shows the drainage system of Patashpur-1 block

originates at Baminigram, near Dudhkundi, under Sankrail police station in Jhargram subdivision of Paschim Medinipur district in the Indian state of West Bengal. It flows past Keshiary, Narayangarh, Sabang and Patashpur to join the Kansai at Tangrakhali under Mahisadal police station of Purba Medinipur district. The combined stream is called Haldi, it is 121km long. The steep slope of the river in Guptamani and Sankrail causes floods. There are many canals in this study area

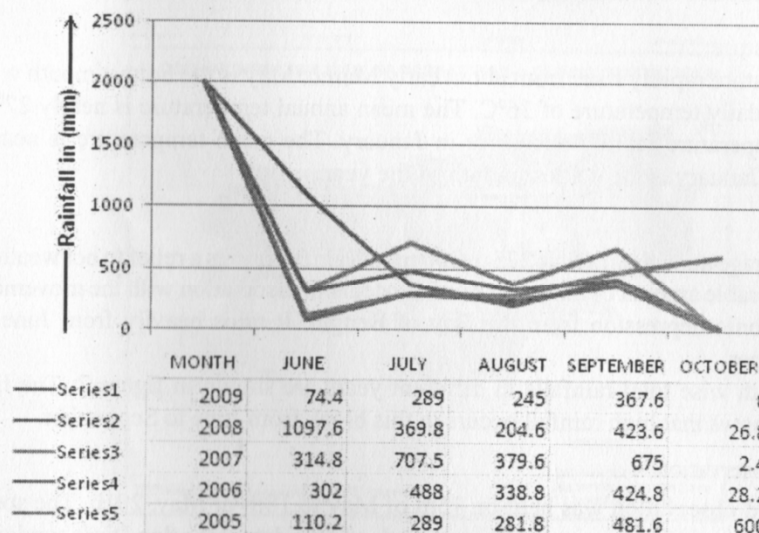


Figure 7. Shows the climate of Patashpur-1 block

namely Bagla (Bagui), Barmui etc. Keleghai river portion of Patashpur-I block have very low to gentle slope. So in this portion more deposition of sand, silt etc occurs, resulting a very low run off at the monsoon time. Hence Keleghai river is characterized by heavy water logging within a very short span of time particularly in the monsoon.

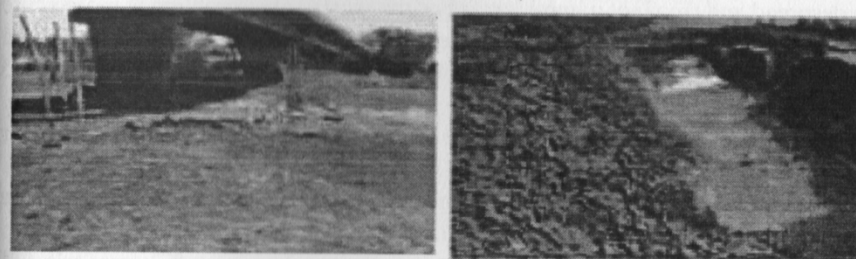


Figure 8. Flood time condition of Patashpur-1 block

### Climate

The study area has a tropical monsoon climate: hot summer with normal to heavy rainfall. The winter season starts from about the middle of December and continues up to the end of February and summer extends up to May. The South West Monsoon season continues up to the end of September. October and the first half of November is the post monsoon. The study area is highly affected by flood in monsoon and continues to be affected in the post monsoon season.

### Temperature:

Temperature rapidly rises from about early March. May is the hottest month with a mean daily temperature of 36°C. The mean annual temperature is nearly 27°C. The temperature rapidly decreases in January. The mean temperature is nearly 19.7°C. January is the coldest month of the year.

### Rainfall:

The average annual rainfall is 275 to 300 mm. Rainfall brings a relief to hot weather. Considerable amount of monsoon rainfall occurs in association with the movement of Cyclonic depression from the Bay of Bengal. It rains heavily from June to September.

Month wise total rainfalls in different years are shown in figure 7. The line graph shows that high rainfall occurs in this block from June to September.

### Field Observation:

The field observation was held on 15th of May to 18th of May, 2010. The socio economic survey over some mouza was made and the data at the flood time condition was collected. Some digital photographs (figure -8) were taken.

## Result and Discussion

A relatively high flow or stage in a river, marked by higher than the usual, causing inundation of low land or a body of water, rising, swelling and overflowing land not usually covered is termed as flood. Flood is probably the most devastating, widespread and frequent natural hazard of the world. This problem is more acute in the areas under strong monsoon regime where 80% of the total rainfall is received in just 3 months. It is evident that the problem of river flooding is getting more and more acute due to human intervention in the flood plain at an ever increasing scale.

Patashpur-1 is a severe flood prone area. In June to September, every year flood affects major portion in this area. This study area has 9 Panchayats and 140 mouzas and 149 inhabited villages. In this area 9 Panchayats and 115 Mouzas are highly flood affected (Fig.9). Flood is caused by Keleghai river water spilling due to narrow river channel, over sedimentation of channel, low run-off, heavy rain fall and very low elevation of flood inundated area.

### Digital Elevation Model (Different Water Level):

This figure (Fig.10) is illustrative of the different water levels showing the 3D surface of Patashpur -1 block. This model is proposed using assumed river water level to predict the areas that will be flooded. This model can provide information about impact of flood on the socio-economic aspects of the inundated area.

### Causes of Flood in Study Area:

Patashpur-1 block is mainly flooded by Keleghai River. Due to heavy rainfall in

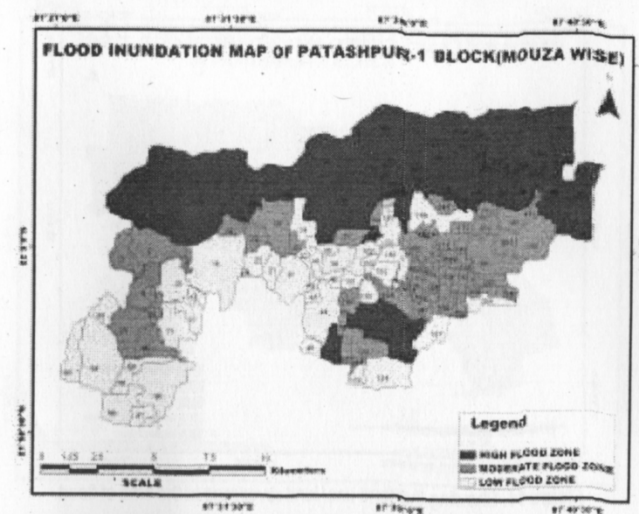


Figure 9. Flood affected area of Patashpur-1 block

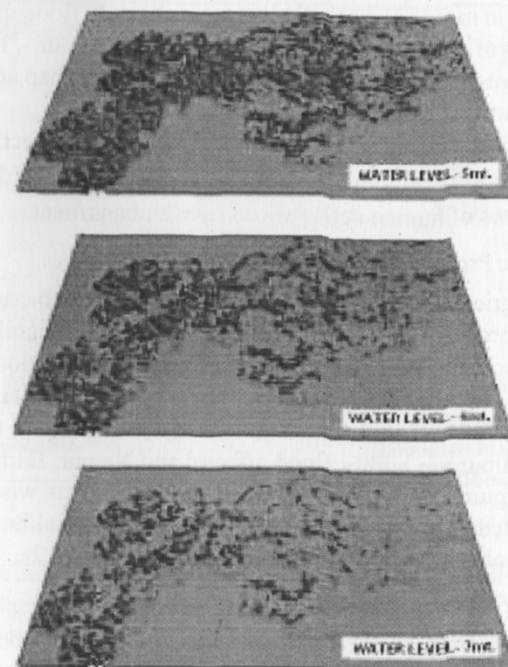


Figure 10. Digital elevation model  
(Different water level)

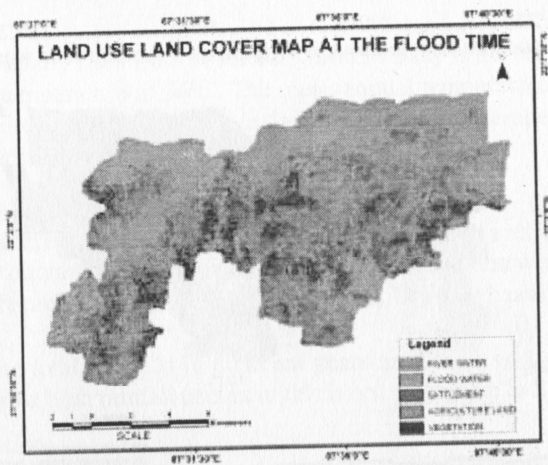


Figure 11. Showing the land use/ land cover map at the time of flood.

this area the river over spills which causes flood hazard. It rains heavily on the river catchment in monsoon time. So this area is heavily flood discharged within a very short span of time & the major portion of Patashpur - 1 block gets flood inundated. Figure 11 is showing the land use/ land cover map at the time of flood. Other reasons are -

- Due to over sedimentation, the run-off of the river has decreased.
- Due to the gentle longitudinal slope of the river bed it has lost drainage efficiency.
- Different types of human activities on river embankment.

#### Socio-Economic Problems Due to Flood:

Flood affects agricultural land and damages houses. It also creates transport and drinking water problem. It also produces the problem of rehabilitation and loss of lives in this block. Patashpur - 1 block has been severely flood affected by the Keleghai river. This flood inundates the major portion of Patashpur - 1 block, 9 Panchayats and 140 villages. Amarshi - 1 and 2, Brajalalpur, Chistipur - 1 & 2, Gokulpur, Gopalpur are highly flood affected and Naipur, Barhat are moderately affected. The figure (fig-12) shows the Gram Panchayats wise total population and flood affected population and (fig.-13) shows the total household and flood affected households all over the block (See also Table- 1&2).

#### Commutation Problem:

Road communication system of Patashpur - 1 block is well distributed in all direction. A metal road coming from Egra subdivision divides into two different ways and goes through Patashpur - 1 block into two opposite direction - one goes towards Bhagwanpur and another to Sabang (Fig.-14). The road communication is severely

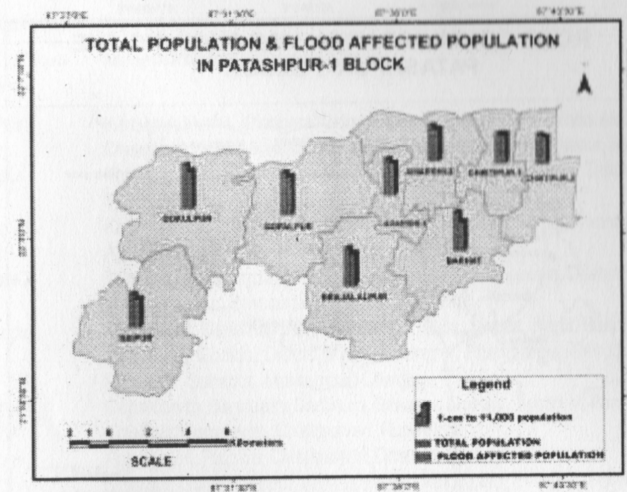


Figure 12. Total population and flood affected population at Patashpur-1 block

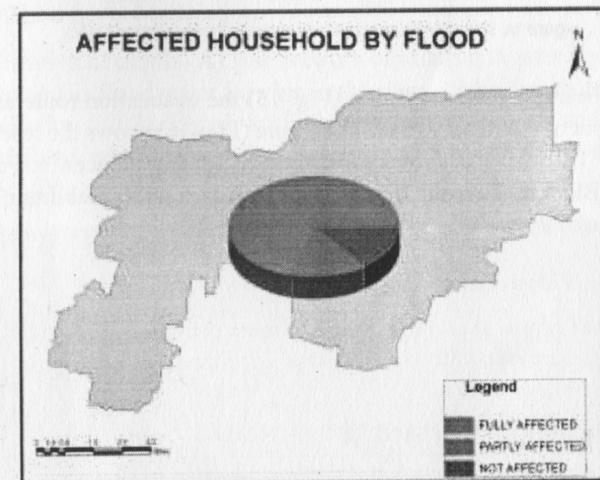


Figure 13. Household affected by flood at Patashpur-1 block

affected by flood in monsoon time. The rescue operations become difficult as the communication system is hampered by flood in different places (Acharyya-2010). The figure (Fig.-14) shows evacuations routes by which rescue operations can be carried out and people can be brought to safe places where Government and Non Govt. organizations can rehabilitate them by supplying food and other necessary commodities.





Figure 14. Road communication map showing the Patashpur-1 block

It is also observed from the figure (Fig.-15) the evacuation route after heavy flood and cut out of the regular road. The figure (Fig.-16) shows the rescue map of the study area. The map also shows 1km. - buffering areas adjacent to Post Office, Schools, and Block Office etc. These rescue centers will rehabilitate the flood stricken people of the inundated areas.

### Managing the Flood Level:

Different type of physical parameter and climate condition of the study area are assessed giving rise to the following proposal of mitigating flood.

Table 1. Total household and flood affected households all over the block

Sl.no	Name of grampanchayat	No. of flood affected mouzas
1	Gokulpur	1,2,3,4,5,26,7,8,24,27
2	Naipur	9,10,60,61,62
3	Gopalpur	28,29,290,23,30,33,35,36
4	Amarshi-1	136,138,140,141,142,143,149,150
5	Amarshi-2	144,145,146,147,176,177,178,179,180,181,186,291
6	Brajajalpur	37,120,121,122,126,127,128,129,135,154,155,156,
7	Chistipur-1	174,182,183,184,185,187,188,189,190,199
8	Chistipur-2	191,192,193,194,195,196,197
9	Barhat	164,165,167,168,169,170,171,172,173,175,204

Table 2. Flood affected areas

Sl. No	Name of Gram Panchayat	Name of the Most Vulnerable Villages
1	Gokulpur	Kanakpur, Pusha, Kharigera, Gokulpur, Amarpur, Kalobar, Tapinda, Maheshpur, Hajipur.
2	Naipur	Chakgopal, Naipur, Madhupur, Madhabpur, Padima, Belda, Mirjapur, Sanya, Haridaspur.
3	Gopalpur	Khidirpur, Ramchak, Paschimjali, Bajitpur, Kharan, Satbahini, Teporpara, Gopalpur, Seimabad.
4	Amarshi-1	Kalmaghat, Hatibandh, Narpara, Shyamikhola, Bankibheri, Amarshi kasba, Purba Amarshi, Agarpara, Soulaveri.
5	Amarshi-2	Taladiha, Gopalsingpur, Bhagwanpur, Saridashpur, Amgechia, Dhakrabanka, Ramkhali, Mahammadpur, Panchuria, Debichak, Barsankar.
6	Brajajalpur	Chakmajait, Banamalichak, Gabdangar, Kajla, Singda, Naria, Paharpur, Brajajalpur, Irda, Tarat, Goalka, Danral, Ramchandrapur, Pitambarpur, Basudevpur, Kutubpur, Hirasagar, Sahapur, Makrampur, Chakjogi.
7	Chistipur-1	Gopalbandh, Barubari, Sarbhum, Sahapur, Gonara, Talchikni, Barmakhhal, Nankar, Chistipur, Gonaraveri, Chistipurver, Rupadighi.
8	Chistipur-2	Palparaveri, Palpara, Chistipurver, Dhankar, Barupur.
9	Barhat	Dulalpur, Gobardhanpur, Joykrishnapur, Nakibasan, Ektarpur, Sadatpur, Barbhagia, Payrachali, Barhat, Chaksagar, Kulakhi, Nilapur, Mahisali.

### Method of Flood Level Moderation:

- Channelization of canals - A close network of canals mitigates flood problem to a great extent as flood water flowing in the river can be distributed to different canals (Rudra, 2002). Canal work as temporary reservoir and contains the water of flood which moves downward. In this way it helps mitigating the casualty of the flood.

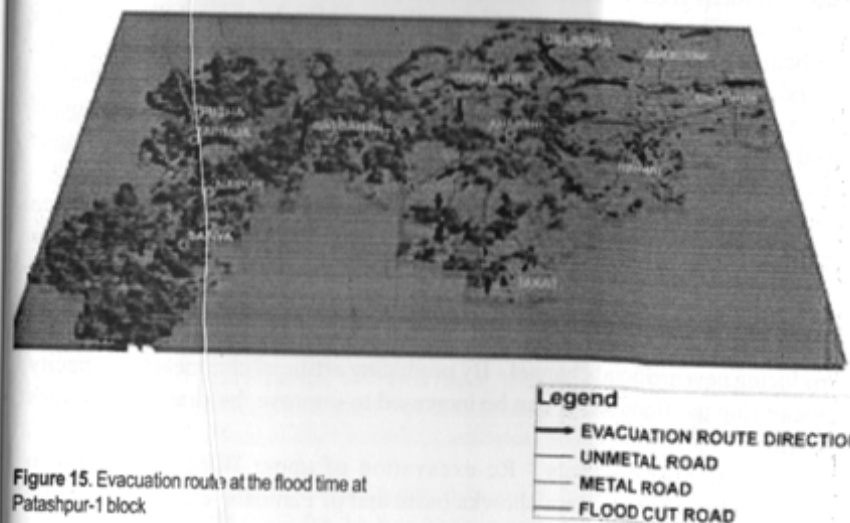


Figure 15. Evacuation route at the flood time at Patashpur-1 block

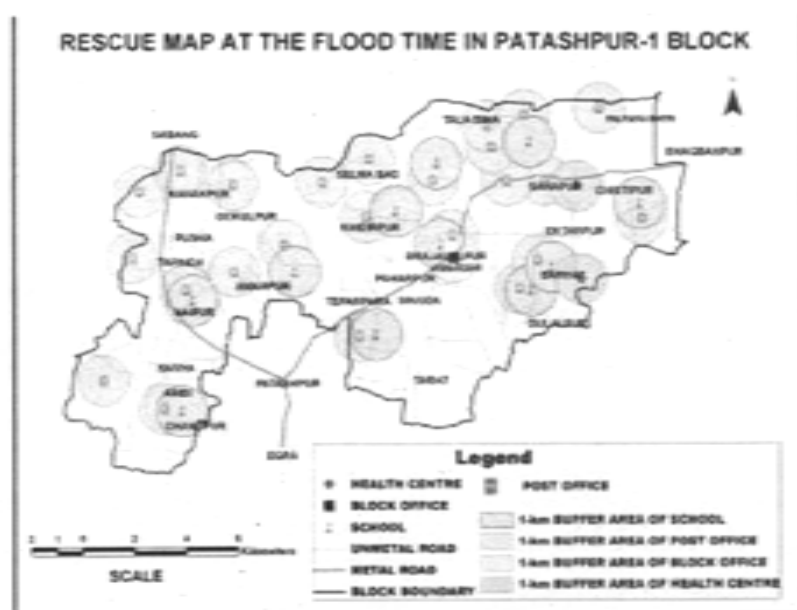


Figure 16. Rescue map at the flood time at Patashour-1 block

- Improvement of water carrying capacity of river - Channel improvement is done by deepening, widening, straightening, and clearing out of vegetation and debris from the river channel. It increases the flood water conveyance capacity of the river. Channel improvement is supplemented by banks stabilization with the help of planting deep root trees on embankment. In a meandering river, meander creates obstacle for drainage and disposal of flood water. The meanders of the river can be straightened by artificially cutting individual or a series of bends. Other measures are changing the alignment of Keleghai near kaptipur and widening the Keleghai river bed near Deuli khal.
- Construction of strong embankment - The possibility of flood on the lower area of the bank of the Patashpur-1 block will be lessened by building concrete embankment. Embankment upliftment of both side of Keleghai River will reduce the possibility of flood. It will prevent the bank erosion and will save the people from flood.
- Producing new artificial channel - By producing artificial charnells the capacity for carrying the flood water can be increased to improve the drainage network system.
- Re-excavation of channels - Re-excavation of upper Bara chowka basin immediately and lower Bara chowka basin and of Paninala khal up to Itaberia

under jurisdiction of Bhagbanpur-2 block will help to remove the excessive flood water from this area. Re-excavation work of canal from Keleghai Dheu bhanga to Amgachia will help to overcome flood.

### Conclusion

Managing flood in any tropical and developing country is difficult for any single agency/organization. Flood has a multidisciplinary dimension where society plays a vital role. With limitation in prediction of rainfall, flood forecasting also cannot be very accurate. If local people can be involved and their knowledge is used for devising a hazard management plan where all available scientific data are also taken as input, then surely some of the indeterminate difficulties of disaster management can be overcome:

Month wise total rainfalls in different years are prepared to show the trend of rainfall and also used for flood modeling. Land use land cover map shows the flood affected zone in Patashpur-I block. It is also observed that the different inundation after using D.E.M of 5mt, 6mt & 7mt. Flood modeling shows that Amarshi - 1 & 2, Brajalalpur, Chistipur - 1 & 2, Gokulpur, Gopalpur are highly flood affected, whereas Naipur, Barhat are moderately affected. An evacuation route of the flood affected people and rescue map for the shelter at the time of flood were prepared after modeling the flood.

Vital aspects of flood management like prevention, preparedness and relief management of flood disaster have been focused in this study - by using Remote Sensing and Geographical Information System. The co-operation of regional people with the State Govt. is the most important factor which will help the flood affected people to have stability in the post flood-situation. The study will help the local people to have some preliminary ideas by which they will be able to save themselves from the ire of flood. If Geoinformatics are used to great extent for various floodplain management activities such as, base mapping, topographic mapping and post disaster verification of mapped flood plain extents and depths, it will give a great prospect for the mitigation of flood.

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