

Department of Geography
Shahid Matangini Hazra Government College for Women
Affiliated to Vidyasagar University
Chakshrikrishnapur, Kulberia, P.O.: Kulberia, Dist: Purba Medinipur, PIN: 721649

GEOGRAPHY FIELD REPORT
2019-20

Introduction: Geography is both a spatial and temporal science and it studies the bond between nature and environment, its distribution over space and evolution through time. Thus, geographers have taken a major role in assessing natural disasters like flood, cyclone, droughts and its impact in the society. Later the aspects of man-made disasters or social disasters like poverty, crime, social inequality are included giving the dynamicity to the discipline. The management approaches have also undergone modifications based on perceptions over time like it has changed from the disaster reduction to disaster preparedness when it was understood that natural disasters are unavoidable. Undoubtedly, more concerns with the intersection of socio-economic, physical and technological and political/legal systems and more sharing areas of interest, knowledge and methods with many other fields of study, will make geography more powerful in the aspects of disaster prevention and management.

Curriculum: U.G. B.Sc. 6th Semester Geography CBCS Honours (Paper C14P- Project Report on Disaster Management) under Vidyasagar University

Title of the Report: 'Ghatal Flood 2017: An Assessment'

Place Visited: Ghatal Town, Paschim Medinipur District, West Bengal

Field Duration: 02-03-20

No. of Student Participant: 17 (Seventeen)

Supervisor: Nabendu Sekhar Kar, Assistant Professor of Geography

Objectives:

- a. To identify the causes and impacts of 2017 flood in Ghatal Town.
- b. To suggest probable management measures to reduce the impacts of this flood prone area of W.B. .

Findings:

Ghatal is one of the most flood prone areas of lower Bengal, located at the confluence of Shilabati and Darkeswar rivers flowing downslopes from Chhotanagpur plateau and reaching the plains. It is found that the low basin like topography and conspicuous drainage system is primary responsible for recurring flood occurrences in Ghatal and surroundings. To prevent the floods and earn more agricultural revenue embankments were placed along the Shilabati, restricting its lateral shift over its flood plain caused siltation of the channel and overflow during storm events. To lower or mitigate the flood impacts removal or modification of the existing embankment system and change in land use are necessary.

VIDYASAGAR UNIVERSITY

SAHID MATANGINI HARA GOVT. COLLEGE
FOR
WOMEN

B.SC. SEMESTER: 6

Ghatal Flood, 2017 - An Assessment

Submitted BY:

SRIJITA MAITY

College Roll No: 16

University Roll: 1125142 No: 170046

Registration No: 1420059 of 2017-2018

Session: 2020

CONTENT

SECTION	PAGE No.
SECTION I Introduction	1-7
Literature review	8-13
Research gap & objectives	13
Methodology	14-15
Background of the study area	16-19
SECTION II Cause of Ghatal Flood	19-27
• Drainage	21-22
• Gauge level fluctuations	22-23
• climatic cause	23-24
• catchment shape	24-25
• Physiographic condition	25-27
• Anthropogenic cause	27
Effect	27-40
• Landuse & Land cover change	27-31
during pre flood & post flood, 2017	27-31
• Area inundated in water	31-33
• Effect & people's perception	33-40
SECTION III Mitigation	40-
mapping	41-43
• Mitigation by Flood Zonation	41-43
• Scientific development of	43
built up area	
• Municipality co-operation	43-44
• People's perception about mitigation	45
• Some other measurement to prevent floods	46
• Ghatal master plan	47-49
Seet SECTION IV Conclusion	50
Reference	51-52
Appendix	53-54

LIST OF FIGURES

FIGURE No.	FIGURE	PAGE No.
Figure 1	Methodology used in the study	15
Figure 2	Location of the study area	16
Figure 3	Gauge level fluctuation at different river station during flood, 2017.	22-23
Figure 4	Rainfall graph of July, 2017	24
Figure 5	Slope of the study area	25
Figure 6	Profile along the embankment & floodplain and profile along the breaching point	26
Figure 7	Landuse landcover map of pre flood and post flood condition	29
Figure 8	Area in percentage of landuse & landcover of pre flood & post flood.	30
Figure 9	Water inundated map at post flood condition	32
Figure 10	Total inundated area after post flood	32
Figure 11	Duration of flooding	33
Figure 12	Effect of flood on the respondents	37
Figure 13	Flood zonation Mapping of Ghatat Sub-division	41

Figure 14	Buffer zone of settlement from river	42
Figure 15	Area at buffer zone of settlement	42 42
Figure 16	satisfactory level of the road respondents	43 43
Figure 17	Proble proble mitigation by the respondents	44

LIST OF PLATES

PLATE No.	PLATE	PAGE No.
Plate 1	shilabati river in post flood	18
Plate 2	Submerged concrete houses during flood	34
Plate 3	Damage of roads	35
Plate 4	Effect of flood	38
Plate 5	satellite image of during flood, post flood	38
Plate 6	Earthen embankment at Ghatal	45
Plate 7	flood time	45

LIST OF TABLES

TABLE NO.

Table 1	Literature review of the study	PAGE No. 8-13
Table 2	Dataset used in study	15
Table 3	Demographic condition of Gehatal sub- division.	27

SECTION I

INTRODUCTION

"Natural Environmental Hazard may be a natural event which is harmful to human and cannot be considered by them to be part of the normal state or condition of the environment, its potential for harm varies with the physical parameters of the event as well as the socio-economic conditions and Political situation at the place of its impact" (Bandyopadhyay, 1997:2)

Flood is the most disastrous natural hazard in Subtropical country like India. Flood is a natural recurring event for river or stream. "It defines the nature of a phenomenon as the overflow of water from rivers or other waterbodies into their catchments due to excess rainfall or melting of snow or some other causes" (Mollah, 2013). Statistically it is found that streams will equal or exceed the mean annual flood once every 2 years (Leopold, 1964). V.T. Chow defined flood as "a relatively high flow which overtakes the natural channel provided for runoff (Jha & Bairagya, 2013). Ward (1978) defined flood as "a body of water which rises to overflow land which is not normally submerged". High flooding results from a combine of conditions - physical exposure and human vulnerability to geographical processes.

The former reflects the type of flood events that can occur, and their statistical pattern, at a particular site, while the latter reflects the socioeconomic factors which such as the numbers of people at risk on the floodplain. It is the balance between these two elements, rather than the physical event itself, which defines flood hazard and determines the outcome of a flood disaster.

Flood may be of two types -

i) River flood: River floods occur when the capacity of stream channels to conduct water is exceeded and water overflows banks. Irregular intervals on all streams and rivers, settlement of floodplain areas is a major cause of flood damage.

ii) Coastal flood: storm surges can be described as an abnormal rise in sea water level associated with hurricanes and other storms at sea. Surges result from strong on-shore winds and/or intense low pressure cells and ocean storms. water levels is controlled by wind, & atmospheric pressure.

Flood is one of the major causes of human misery in India every year. out of 96 internationally recognised natural disasters of India between 1960 & 1981, 28 were floods, earning the unwelcome distinction of being the most flood affected country after Bangladesh.

These natural disasters claimed about 60,000 lives with 15,000 people perishing in floods alone, accounting for about 20 per cent of the global death count. As reported by the central water Commission under the Ministry of water Resources the annual average area affected by flood in India is 1.563 million hectares (Mollah, 2013). In west Bengal the intensity of flood in southern and middle portion is more because of increase of height of channel bed due to huge deposition and poor drainage condition of dam and barrage along river. In northern part portion the frequency of flood is very low. On some rivers the effects of large floods tend to persist for longer periods several recent studies have described the geomorphic effects of monsoon floods in terms of bank failure and channel widening avulsion and large scale sediment transport (Bhattacharyya, 2013)

Flood ~~because~~ become the annual phenomenon in Eastern India and the most affected state is W.B. where 55.43% of total geographical area is flood prone (Jha & Bairagya, 2013). In W.B. the main type of flood which can be seen is river flood as W.B. have the high density of drainage. In north Bengal the flood prone rivers are Mahananda, Teesta, Raidak etc. In the south Bengal the major flood occurs by Bhagirathi - Hugly river, Damodar, Shilabati Kangsabati river. In the occurrence of

natural Hazard, flood ranks first in W.B. Almost all the districts are affected by flood from July to October. According to the Irrigation Department, 37.6 Lakh Ha of W.B. has been identified as flood prone area. The degree of the flood problems in the state of W.B. can be assessed from the fact that more than 42 per cent of its geographical area has been identified as flood prone and about 25 per cent of its area is below the high flood / high tide levels.

The flood causes loss to human life and widespread damage to property. Unimaginable damage to agriculture takes place affecting the state's planning and upset the financial budgeting there by slowing down the whole economy of the country (Das & Bandyopadhyay, 2015). In the southern deltaic part of W.B., where the alluvium deposits is high and the rapid urbanization is taking place affected by in every monsoon period. Ochatul block of ~~W.B.~~ West Midnapore district is the most affected area in southern part. Excessive monsoonal rainfall from July to September month & additional dam discharge water from Mukutmanipur & D.V.C. reservoir, backing of waters in tributaries at their confluence with the main river

Poor natural drainage, intense rainfall when river is flowing full are mainly responsible for flooding in this Block and create a great havoc to the people's life. Cyclone formation on the head of Bay of Bengal from the month of October to November is also the cause of flood in this Block (Kark Das, 2014). Flood in Ghatol is not new, it is a phenomenon since 18th century. According to the Governmental report the most disaster prone flood years are 1823, 1833, 1864, 1914, 1916, 1942, 1956, 1959, 1968, 1971, 1973, 1978, 1989, 1995, 2007 & 2013. In 2017 this area also affected by severe flood in the month of July due to heavy rain & the physiography of Ghatol (Taylor & Francis, 2017). Every year during the monsoon period Ghatol is affected by flood which causes, property loss etc. In 2017 this area also flooded due to heavy rainfall and high discharge rate of Shilabati river. From July 20 to July 30 this area affected by high flood. Pratappur in Ghatol subdivision is mostly affected by flood.

In order to mitigate flood losses, a number of structural and non-structural measures have been taken over time in the form of embankments, drainage improvements, anti-erosion work & raising of villages, and ~~more~~ nonstructural measures such as flood forecasting and warning system. Flood hazard comprises structural damages due to erosion-causing loss of life and property, contamination of water & other materials, disruption of socio-economic activity including transport & communications & the spoiling of agricultural land (Merz, Kreibich, Schwarze & Thielen, 2010). At present, all over the world the experts are of the opinion that structural measures alone cannot provide safeguard against floods. A flood hazard should be thought as a socio-economic phenomenon also, not merely a physical one. Therefore, not only the physical aspect of flood but also the socio-economic dimension of it should be considered by any holistic study of the hazard.

Some positive measures should be selected or created to decrease the effect of flood in Gchatal. Non structure measures like flood zonation mapping, Flood forecasting should be taken. Using non-structural measures, on the other words than monetizing with flood is a new approach in flood damage mitigation. Flood zonation map is one of the subset and could be applied as a proper tool in flood basin management. So that in normal condition is a guideline for construction of structures & infrastructure and in flooding condition could set the evacuation routes & safe sites. In order to the suitability of plains for economical activities & also population concentration, most of people, without any knowledge of flood risk, attempting to build structure construction & also affects the population concentration sites. In many developed countries, the preparation of FZM is required for industrial & population area & most of settlement & development plans consider FZM. Municipality, city officials and building settlements, officials of commercial & industrial unit plans & even NGOs are custodians for FZM preparation. On the other hand as people are mostly affected by flood the perception of the inhabitants should be taken into account & the measures should be made on that basis (Seyf, Ahmadi, Shiringade & Sadeghi, 2011).

LITERATURE REVIEW:

Several literatures have been followed to studied the cause, effect & mitigation regarding the flood of Gchatal sub-division. The following proposed papers are all based on river, flood, previous flood of Gchatal, positive mitigation for the flood. Some of the papers are also based on the drainage system & flood plain analysis of w.B, which helps to understand the drainage system & the general geomorphology of the study area. Literatures are generally reviewed to find out different types of methodology techniques & the research gaps.

Several books, papers, published & unpublished phd works, governmental reports have been used for this study. Online sources like google scholar, sodhganga, research gate are also been used. Following are the literatures which are reviewed.

Table 1: Literature review of the study

<u>Year of Publication</u>	<u>Author</u>	<u>Findings</u>
2013	Bhattacharyya; Abhishek	<ul style="list-style-type: none"> i) This paper give an clear idea about flood & their different stages. ii) The types of flood & the interval of flood can also be found from this study. iii) It emphasizes on the major flood prone area in w.B.

2003

Dutta et al.

i) This paper introduces an integrated model for flood loss estimation in a river basin. The model is the combination of a physically based distributed hydrologic model & a distributed flood loss estimation model.

ii) It describes the man-made flood control structures, such as river embankments, retarding basins, etc. which affect flooding characteristics.

2013

Annual Report of Irrigation & Waterways Department, Govt of W.B.

i) The flood trend of W.B. as well as the total region summed up in this report.

ii) Total flood inundated area & flood affected area of 2012-13 can be known from the report.

2015

Biswas et al.

i) This article describes anthropogenic activities affect the river channel as well as the entire basin with different magnitude & dimension.

have ii) The human activities ~~has~~ been evaluated through satellite images while decadal & yearly floods have been monitored with satellite image & field survey.

iii) the downstream region of the basin is experienced with yearly & decadal flood, & these are experienced with the artificial levee construction & high rainfall respectively.

2015

Das et al.

i) This paper discussed the present state of flood at a junction point between two rivers at Bandan at Ghatal block.

ii) Genetic delta & proposed a technological solution to reduced vulnerability of flood.

iii) Flood Management & Mitigation is designed to minimize negative flood-related impacts while preserving the benefits. Flood mitigation involves the managing & control of flood water movement, such as redirecting flood run-off through the use of flood walls & flood gates, rather than trying to prevent floods altogether.

ii) The study also involves the management of people, through measures such as evacuation & dry/wet proofing properties for example.

2012

E. Martinez Ibarra. i) The study demonstrates the importance, in general, of adopting a geographical (integral) approach and local analysis to determine flood risk in small Mediterranean basins, where normally there is no surface runoff. At the same time, it highlights the possibilities afforded by a post-flood study.

ii) The study seeks to identify the factors that aggravated the impact of the extreme flood event in the tourist town of Calpe (Alicante, Spain) on 12 October 2007.

2017

Kaunetal.

i) Effective disaster risk reduction strategies can be improved by geospatial approach in the way of producing information and knowledge that are useful to plan truly effective actions for the protection from floods.

ii) The research aims to develop a quantified predictive model of flood susceptibility in the Gohatal & Tamlek subdivision of Medinipur district of W.B, India, by means of empirically selected and weighted spatial predictors of flood.

2014 Mandal Sahoo et al. i) This paper emphasizes upon vulnerability assessment of flood in Gohatal block.

ii) It also envisages the effect upon communities who are open to the flood disaster.

iii) It will also focus on the developmental plans taken up by the government & proposal of preparing a framework on flood risk-management plans to combat such increasingly adverse environmental conditions.

2010 Acharya et al.

- i) the study describes an efficient & scientific approach with suitable illustrations of map & real time flood ~~in~~ inundations. Here basically the flood inundated area is delineated from satellite image through digital technique.
- ii) The study also highlights the application of satellite images to assess the damage caused by flood.

RESEARCH GAP AND OBJECTIVES:

As identified from the literature review there is considerable research gap in the effect and measures of flood in Ghatat sub-division. Effective measures should be taken with the help of the people's perception & their livelihood during the flood days. After recognizing this gap the principle aim & objective of the study are as follows:

- i) To show the cause and effect of the 2017 Ghatat flood on the inhabitants of the area.
- ii) To find out the probable remedy of this disaster.

METHODOLOGY:

Multi Multiple databases have been used during pre field, during field & post field work. Both primary & secondary data have also been used in this dissertation work.

Field technique: - To determine the height of the embankment and the flood plain an auto level survey has been done in the post flood condition in the embankment, natural levee & in the flood plain at the shibabati river in Pratappur. The primary data has been obtained based on questionnaire survey, which is concentrated on frequency & duration of flooding, problems faced by local people during flood, effect on their livelihood, pattern during flood, availability of government aid to get the perception of the flood affected people, and the effect of flood on the geo economic setup.

Geospatial database: - Two LANDSAT 8 data, one for pre flood and the other for post flood have been used for land use Land cover classification for elevation and flood zonation mapping ASTER DEM at 30 meter resolution have been used. All the geospatial work done in ERDAS imagine & ARC GIS software. Indian Meteorological Department & W.B. water and Irrigation Department provided all the secondary database the rainfall data and the gauge height data has been obtained to show rainfall variation & the gauge level fluctuation.

DATASET USED IN THE STUDY: STUDY:

Table 2: Dataset used in study

Date of acquisition	Satellite	Sensor	Path/bow	Resolution
16.03.2017	LANDSAT-8	OLI-TIRS	139/044	30m.
1.12.2017	LANDSAT-8	OLI-TIRS	139/044	30m.
17.10.2011	ASTER GLOBALDEM	ASTER	139/044	30m.

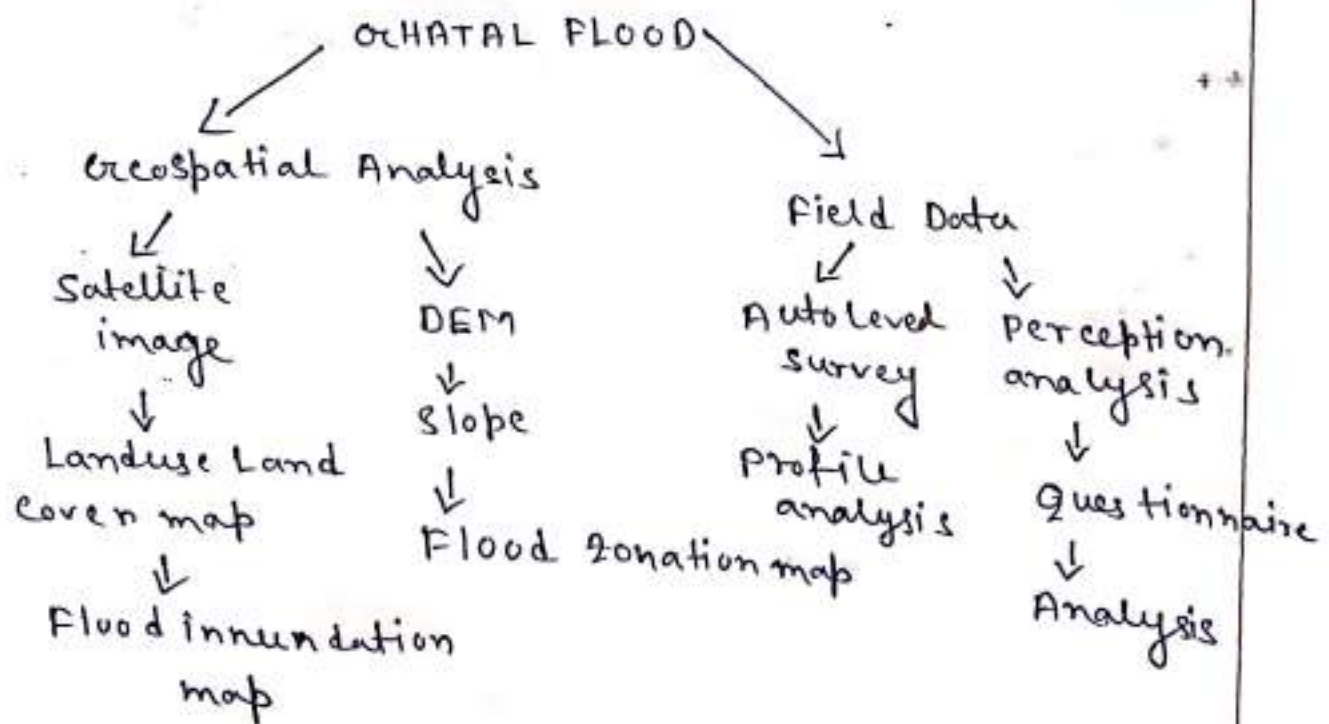


Figure 1: Methodology used in the study.

BACK GROUND OF THE STUDY AREA:

Ghatal sub-division is located in ~~an~~ west midnapur district, w.B. extended from $22^{\circ}40'12.00''N$ to $87^{\circ}43'12.00''E$. It is situated in the interfluvial parts at i) shilabati & shankari river ii) shankari and Darakeswar river and iii) shilabati & Rupnarayan river. This sub-division have total 5 blocks: Chandrakona I, Chandrakona II, Ghatal, Daspur I, & Daspur II. Among all the five blocks southern part of Ghatal, Daspur I, and Daspur II are highly affected by flood.

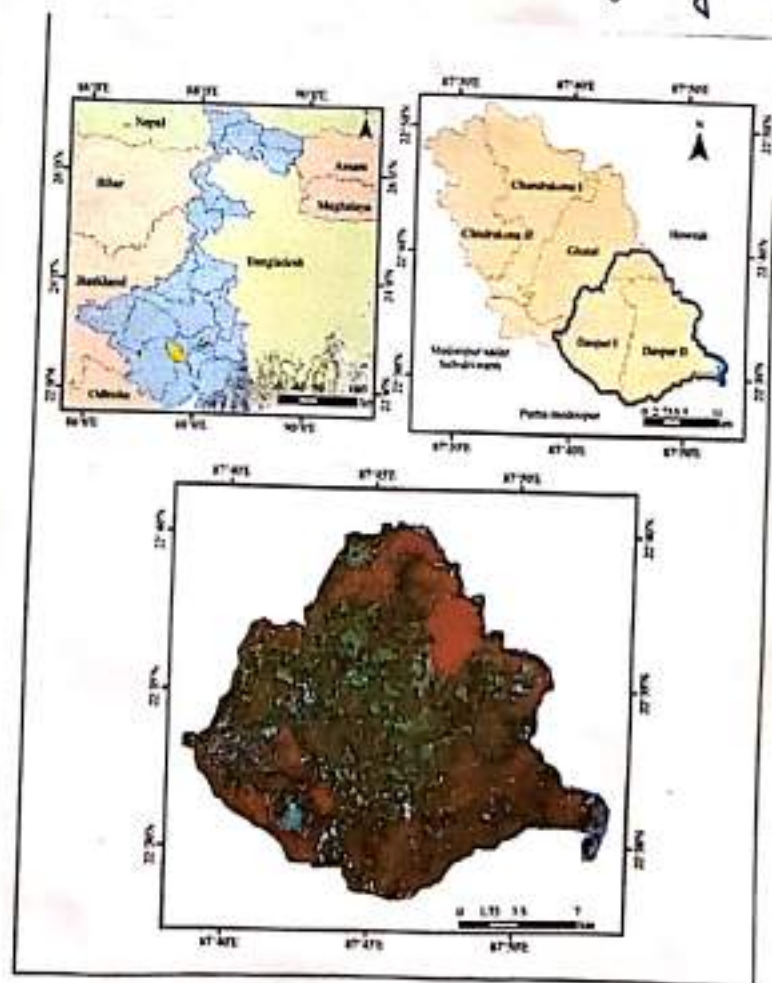


Figure: Location of the study area

Physiographically the total Medinipur area fall under 5 macro regions:

- (i) Medinipur upland.
- (ii) Silai Plain.
- (iii) Lower Kasai Plain
- (iv) Contai Plain
- (v) Digha coastal plain.

Gchatal fall under lower Kasai plain. It is the largest plain area of undivided Midnapur district. The upper eastern part is experienced with the deltaic nature while the lower northern part is experiencing the tidal influences; ebb & flow is very much active in this region. It is a long depressed area characterized by low lying tract of alluvium. This is formed due to the assimilation of the deltas of Kasai & Silai in the north-west portion which is triangular in nature. The rate of alluvial deposition is very high as for the river bed of Kasai is totally lost her navigability (Mandal 2015). It falls under the micro basin of Shilabati river. Gchatal has a tropical monsoon climate hot ~~summer~~ summer & well distributed normal rainfall. There are mainly four seasons found. The winter season starts from about the middle of December & continues up to

the end at September, October & the first half of November is the post monsoon. The area is highly affected by flood in monsoon. The area is highly affected by flood in monsoon season.

Temperature rapidly rises from about early March. May is the hottest month with a mean daily temperature at 32°C . The mean annual temperature at is nearly 27°C . The temperature rapidly decreases in January. The mean temperature is nearly 19°C . January is the coldest month of the year.

The average

annual rainfall is 275 to 300 mm. 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. High rainfall occurs in this area from June to September.

Ghatul and its adjacent area is highly flood prone segment by the River of Shilabati & Kangsabati. In the British period Ghatul was divided by ~~many~~ many small zamindars. After



Plate 2. Shilabati River in post flood condition

Starting the permanent settlement the local Jaminars prepared circuit bank in their locality on the rivers in their areas to protect the flood & extend the productive land for increasing the total income. As a result when flood water comes from the upstream & high tide water comes from the sea then accumulated water continuously store on the river channel. So, the flood plains area of the river becomes lower in respect to the accumulated water on the river channel. By the gradually assembled of silt in the river bed it becomes a high area than the nearest areas and at the same time the rate of flood increased than the normal situation. As a result in one side these become barrier to discharge excess flood water & in other side as the internal areas of the river bed is lower than the river bank, resulting the critical problem of drainage. To save the block from the flood there are six circuits around Ghatul Block & adjacent areas. Among them three are abandoned (Kar & Das, 2014). The circuits are Dussapur circuit, Mohankhali circuit, Chetua circuit, Manajole circuit, Panna circuit and Ghatul circuit among these the ~~use~~ later three are abandoned.

SECTION II:

Causes of Ghatul flood:

Flood is the causes of single or jointly interconnected by a number of factors. Common

natural factors are: intense storm precipitation high antecedent basin, soil moisture, rainfall over areas covered with snow, occurrence of medium to major storms in quick succession & failure of dams resulting in a very rapid release of large quantities of water (Siegrist & Grutche 2008). But sometimes physiographic ~~causes~~ location of river basin & intervention of people also cause of flood. Natural factors which cause river floods, important are prolonged high intensity rainfall; meandering courses of the rivers; extensive flood plains; break in slope in the long profile of the rivers; blocking of free flows of the rivers etc (Singh S, 2009).

Flood is Ghatal is not a new phenomenon. It held from the 18th century. From the meteorologic report of the Government it is found that every year in monsoon Paschim Medinipur is flooded & one of the flood prone subdivision of the area is Ghatal. The major blocks which are inundated in water during flood days in 2017 are Daspur I, Daspur II, Ghatal. The major cause of Ghatal flood is not only the intense rainfall at monsoon period and the cyclonic activity of Bay of Bengal, it is also because of the physiography, soil & anthropogenic factors.

"Floods vary in degree of severity in terms of area extent or magnitude and in depth. They are thus classified as minor or major flooding. In a minor flooding, inundation may or may not be due to overbanking. When there is no bank overflow

Flooding is simply due to the accumulation of excessive surface runoff in low lying flat areas. Floodwaters are usually confined to the flood plain at the river along the channel or random low-lying areas & depressions in the terrain. Flood water is usually shallow & there may not be a perceptible flow.

During a major flood, flooding is caused by the overflowing of rivers and lakes; by serious breaks in dikes, levees, dams and other protective structures; by uncontrollable releases of impounded water in reservoirs & by the accumulation of excessive runoff" (Das & Bahdyopadhyay, 2015). Floodwaters cover a wide contiguous area and spread rapidly to adjoining areas of relatively lower elevation. Flooding is relatively deep in most parts of the stricken areas. There is a highly perceptible current as the flood spreads to other areas. While floods take some time, usually from 12 to 24 hours or even longer to develop after the occurrence of intense rainfall, there is a particular type which develops after no more than six hours and frequency, after an even less time. These are what are known as flash floods.

Drainage:

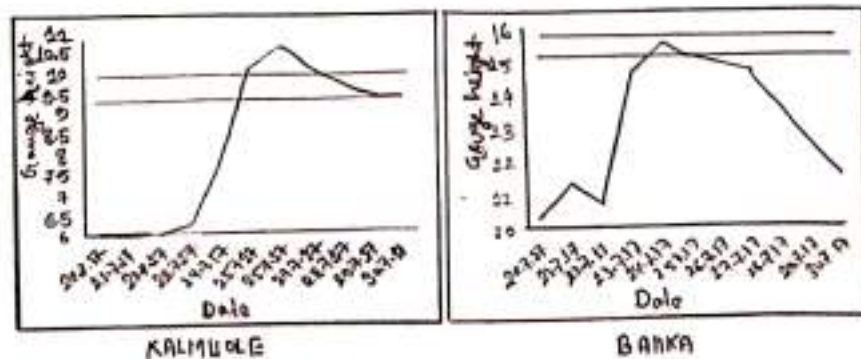
If we look after the drainage condition of Ghatal subdivision it can be found that it is comprised of four major rivers.

- i) Shilabati.
- ii) Rupnarayan.
- iii) Old Cossey.
- iv) Kangsabati.

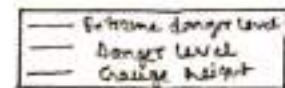
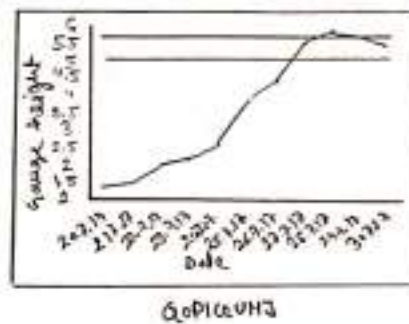
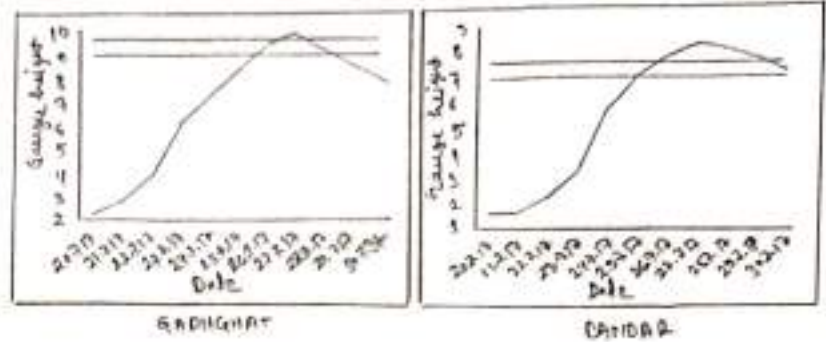
Chatal fall under the micro basin of shilabati River. River silabati & Dwanakeswar meet at Bandar, & the combined flow is named as Rupnarayan, which joins river Hoogly at Geonkhali covering a distance of 78 k.m. So in monsoon season two rivers carry huge amount water & when meet the junction point at Bandar, and water is overflows. Because catchment size of river is not enough here (Kar & Das, 2014). The carrying capacity of shilabati river is decreasing because of the high rate of sedimentation. In the monsoon period both shilabati & Rupnarayan river overflowed due to this low carrying capacity. Semi-diurnal tide is active here & tidal impulse penetrates a little beyond Bandar. Tidal bore of lower magnitude is an important phenomenon at that junction.

Gauge level fluctuation:

Chatal sub-division is mainly covered by Banka, Gopighat, Bandar, Gopignis & Kalmjole river station. From the data of gauge height from 20.07.2017 to 31.07.2017 it



is found that river Rupnanayan, river shilabati both are flow over the danger & extreme danger level.



Source:

<http://www.wbiwd.gov.in/index.php/applications/dailyreport>

Figure 3: Gauge level fluctuation at different river station during flood, 2017. It implies that Kalmijole, Gadighat, Bandar river station have the highest level of gauge height fluctuations on the days of 24th to 28th of July. That means the shilabati river, Rupnanayan river, and the old cossey river are flowing above the extreme danger level.

climatic cause:

The study area fall under monsoon climate. Therefore maximum amount of rainfall concentrated in sudden period & the other months are dry in nature. High rainfall in monsoon season is main cause the flood in Gchatal sub-division. The average rainfall of July month, 2017 is 16.23 mm. But approximately 9 days of July month have ~~not~~ crossed the

average embankment in Pratappur (high flood affected area in 2017). This rainfall concentration for few months in a particular year may cause a flood because each river has some capacity to carry the volume of water. But huge amount of water in a sudden period is the cause of overflow in the Silabati River & its tributaries. The poor availability of water in summer season is the cause of river water scarcity. Continuous intense rainfall increases the water volume in Silabati & Rupnarayan River.

because of high sedimentation their carrying capacity is low & overflow causes flood in this study area.

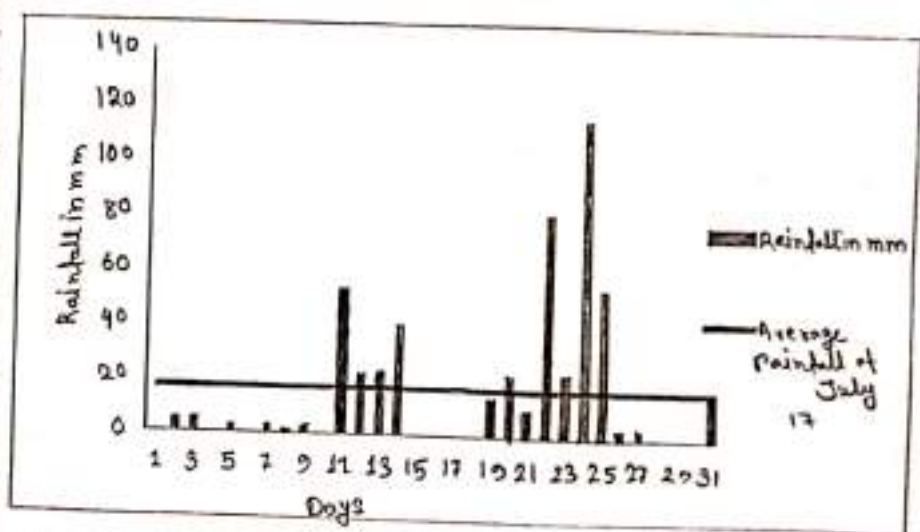


Figure 4: Rainfall graph of July, 2017

Source: ~~http://~~ <http://www.wbiwd.gov.in/index.php/applications/dailyreport>

Catchment shape:

The actual width of the river Silabati & Dwarakeswar is 50m, but it is 80m. for Rupnarayan. The expected width at Rupnarayan is 66.66 m. The increase in volume of water due to tidal effect is one important cause for the extra width at Rupnarayan River at Junction.

The sudden widening causes flow separation leading to increased sedimentation (Das & Bandyopadhyay, 2015).

Physiographic condition:

The general slope at Gchatal sub-division is 15 to 5°. The study area is mainly flood plain at newer alluvium deposition. The previously prepared circuit banks in this area is another causes of flood. The excess water from up stream & tide water from sea accumulated on the river channel. So, the flood plains becomes

Lower in respect to the river bed.

Gradual assembly of silt in river bed makes the flood plain lower than the river channel.

As a result one side become barrier to discharge excess flood water & in other side as the internal areas at the river bed is

Lower than the river result flood.

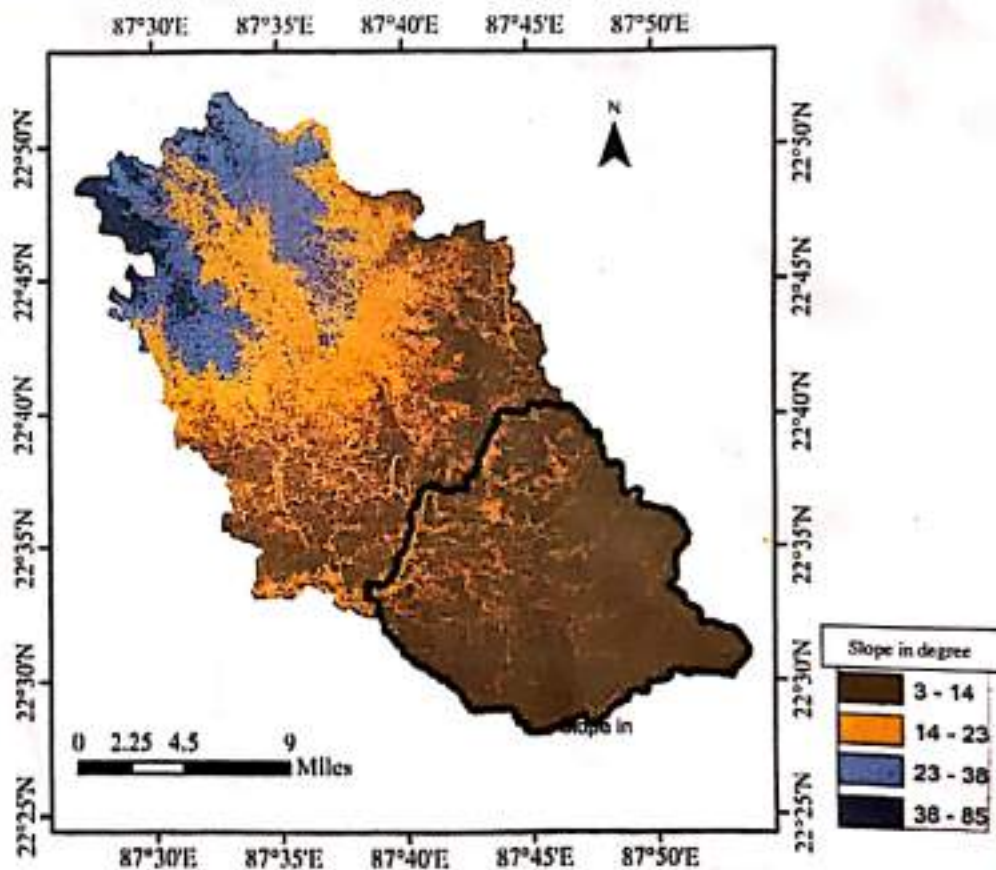
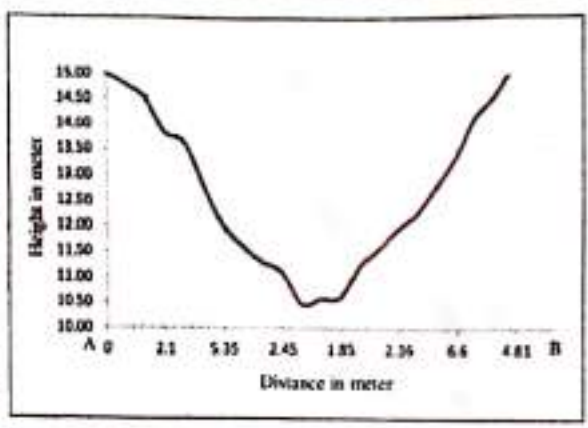
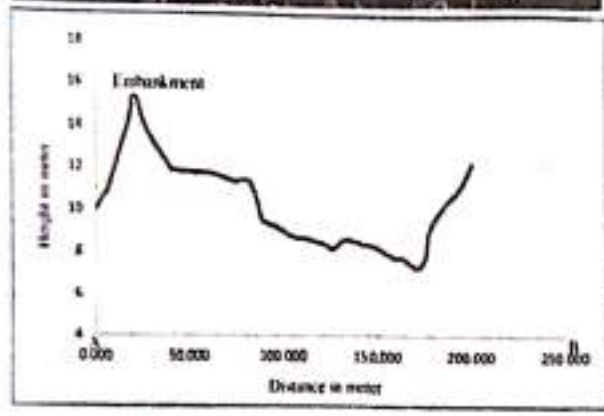


Figure: slope at the study area



Source : Auto level survey .

Figure 6: profile along the embankment & flood plain (left) & profile along the breaching point (right). Figure 6 shows that the lowering at flood plain in Shilabati river & the gradual site siltation decreases the carrying capacity at Shilabati river. In the flood time the excess water destroys the earthen embankment & flooded the adjacent villages every year. During monsoon huge amount of rainfall has been occurred in a certain period & the Shilabati & its tributaries are carrying huge amount of rain water from upper catchment & concentrated on this certain place. For the shortage at 'basin lag time' the

river silabati could not capable to carry this huge water, causes of river over flow in the Gchatal. Sometimes this huge water pressure may cause of embankment breaching.

Anthropogenic causes:

The study area have high population density in Daspur I, Daspur II, and Gchatal block. The study found that most of the flooded area is also lies between these blocks. So it can be said that anthropogenic causes is also responsible for flood in Gchatal. Unplanned increase of built up area besides the river bank, earthen embankment causes flood.

Table 3: Demographic condition of Gchatal sub-division.

CD Block	Population 2011	Area (Sq. km.)	Population density
Chandrakona I	1,36,006	193.54	702
Chandrakona II	1,23,269	150.44	819
Gchatal	2,19,555	216.05	1016
Daspur I	2,03,987	168.3	1212
Daspur II	2,38,529	165.45	1441

EFFECT:

Landuse and Landcover change during pre flood and post flood, 2017:

Landuse Land cover classification is simple and widely accepted method to classify the

spectral values into several classes by using several algorithms, with or without the classifier's discretion. Landuse classification is difficult due to heterogeneous spectral properties from satellite image medium-range spatial resolution. In the present study, LULC change was assessed between 2017, march (pre flood) and 2017, december (post flood). The maximum likelihood classification method was used and analysis was conducted using ERDAS Imagine 9.0 Software.

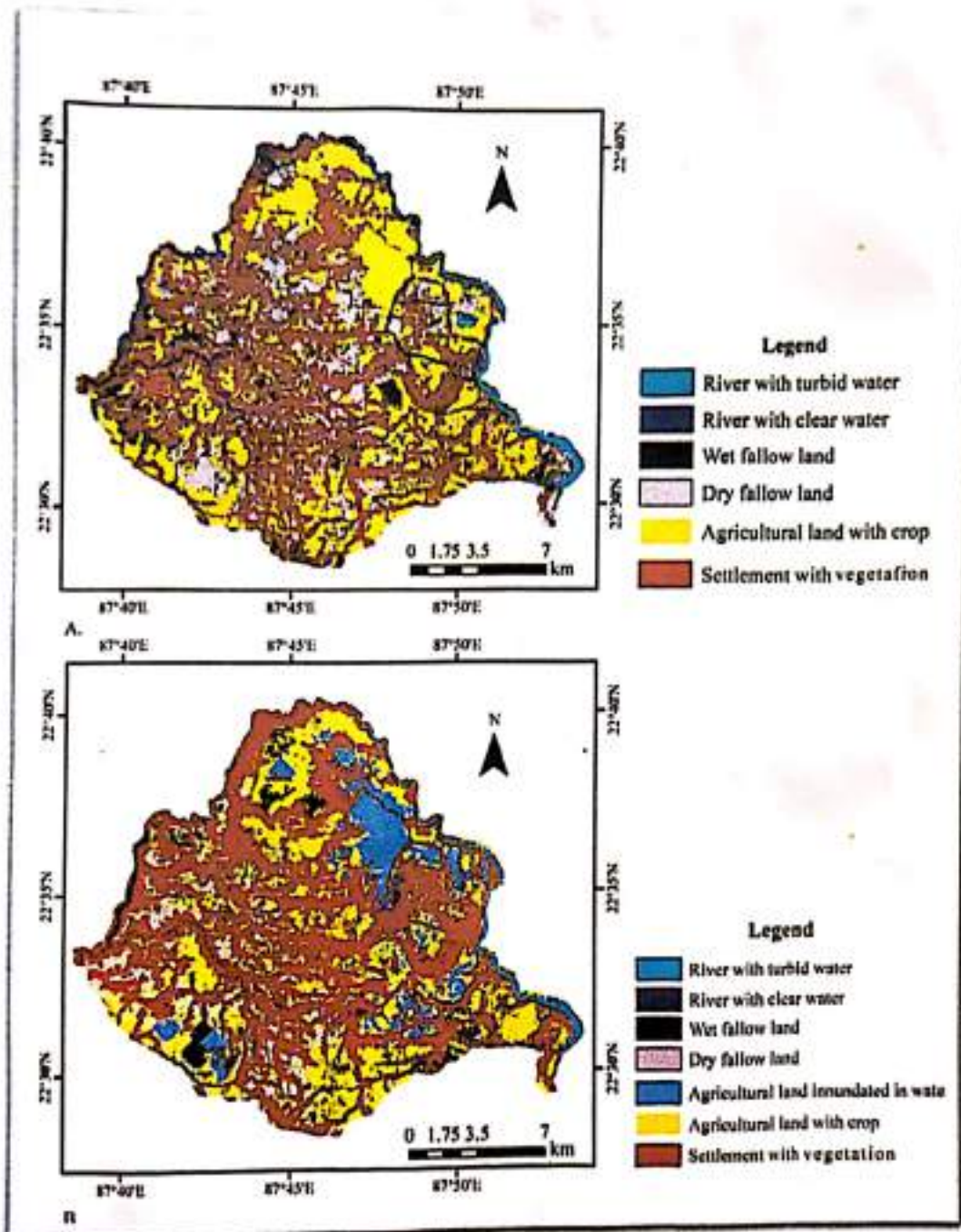


Figure 7: Landuse Land cover map of pre flood (A) & post flood (B) condition.

A huge change in the pre flood & post flood condition of 2017 can be noticed from the landuse & Landcover map. Inundated area after flood days, can be prominently determine from the map. The landuse & Landcover map takes the flood affected area only that is Daspur I blocks.

Daspur II block & a part of Ghatal block. In the pre flood situation most of the field is occupied by agricultural land. The settlement of this area mostly situated in the natural level levee formed by two major rivers Rupnarayan and Shilabati. In the pre flood situation river water is mainly clear where as the opposite thing happen in post flood condition.

Figure 9 shows the percentage of each Land use & land cover both pre flood and post flood. It is clearly shown that after the occurrence of flood about 7% of the total area is under.

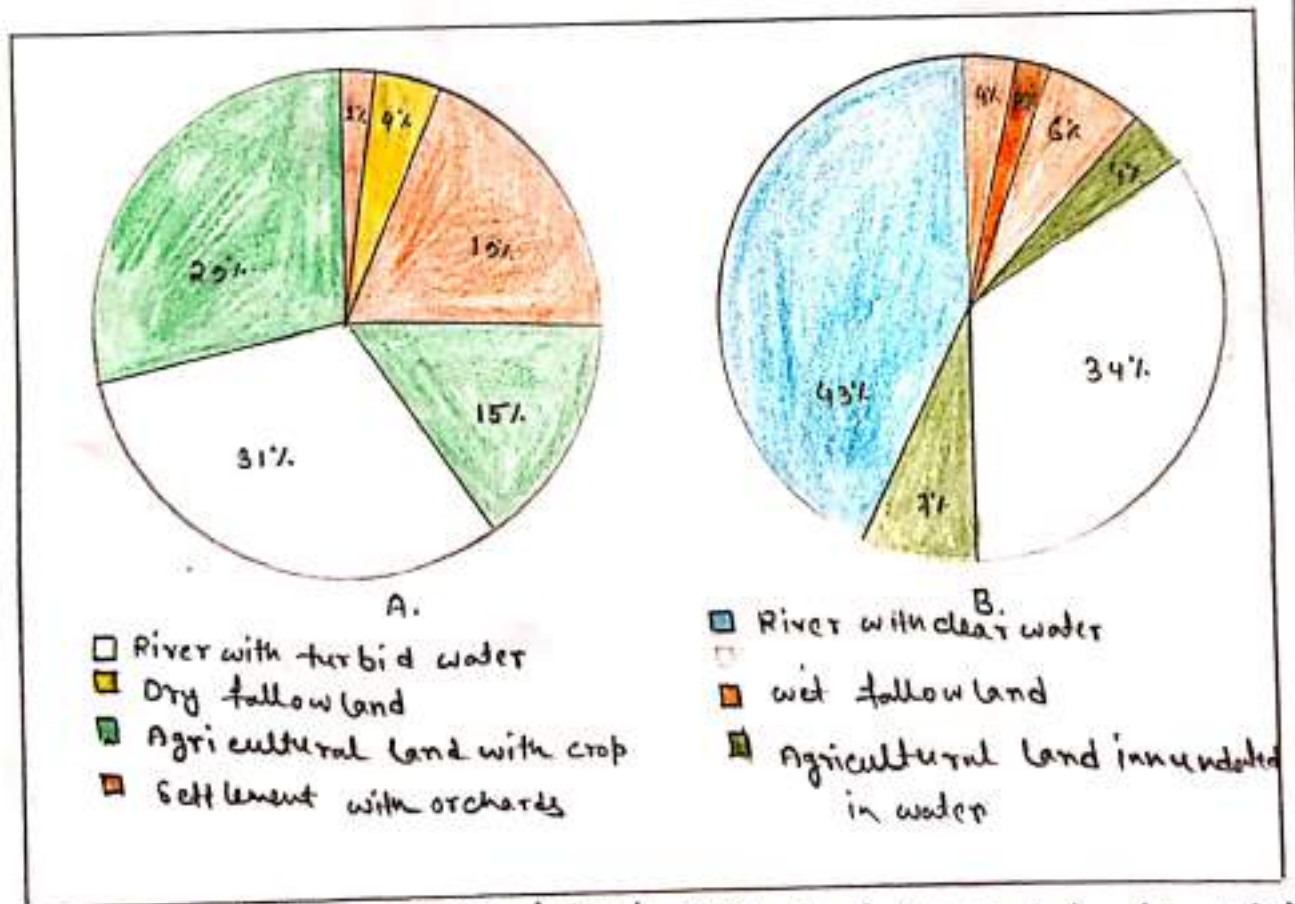


Figure 8: Area in percentage of land use & land cover of pre-flood (A) & post flood (B)
 Source: Primary questionnaire survey

water also in december. There is huge decrease at dry fallow land & wet fallow land also. Study shows that the inundated water in the flood plain of study area can not flow out quickly. It become standing for few months sometimes for a year. It is seen from the figure that settlement with vegetation have increases to 29% to 43% in just 8 months gap. This may be because of the rapid growth of vegetation in the inundated water & monsoon period, although settlement also increases at a very small rate. Most of the built up area are found in natural levee. The turbid water percentage of river carrying have also increases to 2% to 4% & the percentage of clear water at river decreases. In the flood situation river carries water with huge high sediment load from the upper catchment area due to heavy rainfall, this increases the amount amount of sedimentation in the river bed. Here it is noticeable that the amount of wet fallow land & the amount of dry fallow land decreases, It is because of the most of the land are inundated in flood water.

Area inundated in water:

From analysis the post flood condition of the circuits at Gchatal sub-division it is clear that after 3 to 4 months of the occurrence of flood a huge portion of the area is

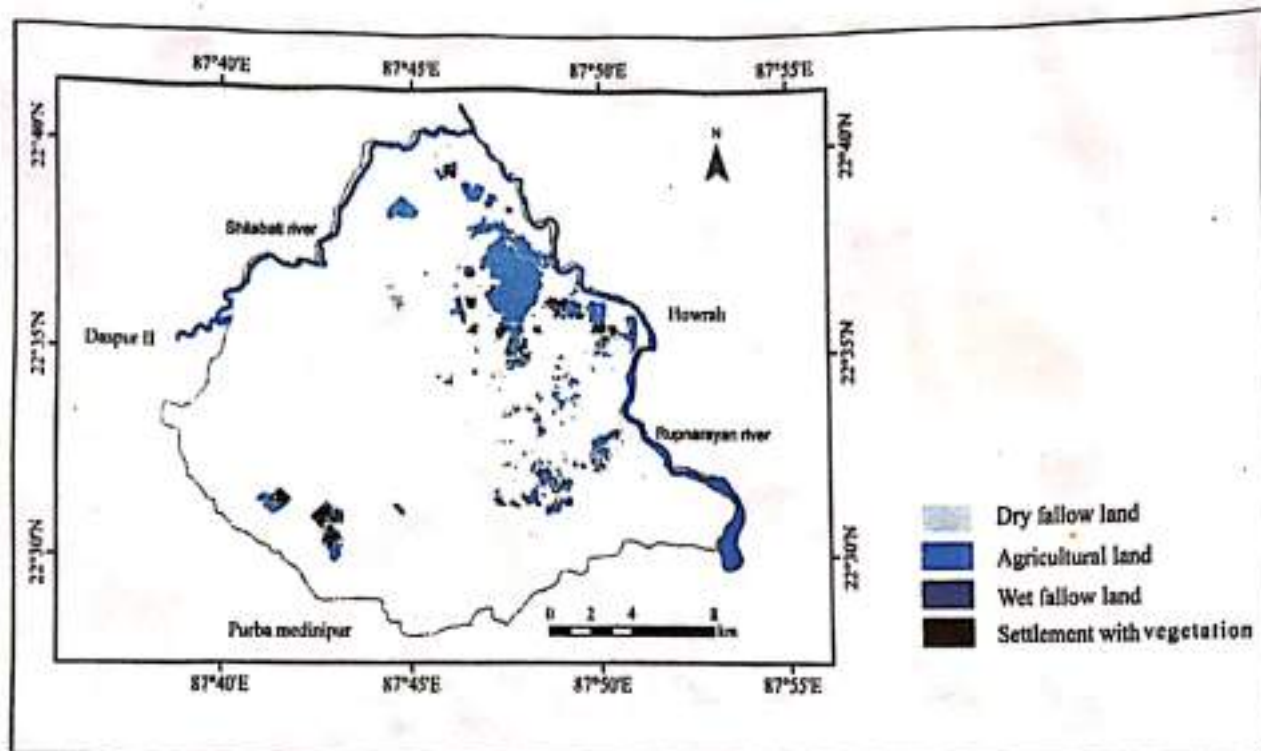


Figure 9: water inundated map at post flood condition. Among them most of the land are agricultural land. Figure 10 shows the under water area is beside the shilabati & the rupnarayan river.

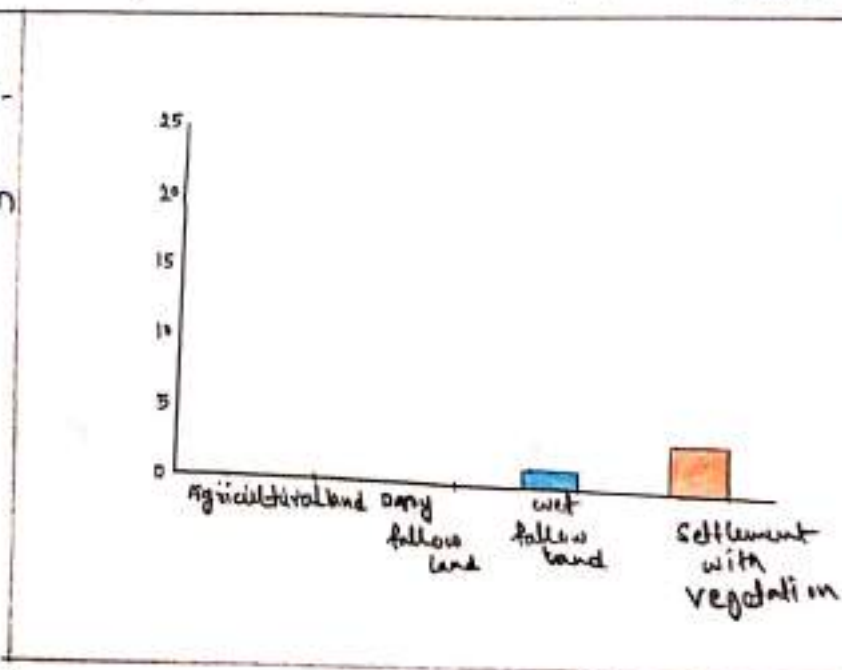


Figure 10: Total inundated area after post flood.

In the meeting point of two rivers there is no space for the pass out of the excess flooded water in this area & it become stagnant which denote the poor condition of drainage system. Among the total area of the circuit banks about 20% of agricultural land is inundated in the post flood situation. This is highly remarkable because most of the people in the study area are engaged in agricultural activity & this denote the occasional unemployment phase of the area. About 5% of settlement, vegetation & wet fallowland are also submerged in water.

Effect & people's perception

Flood directly hamper & disrupt the people's daily way of life. So, studying about flood effect it is necessarily needed to accompany the people's perception regarding the effect & mitigation of flood. The perception about the causes, external.



Figure 11: Duration of Flooding
Source: Primary questionnaire survey

Facilities, management alternatives is differing from severe flood prone areas & less affected areas. Generally flood affects the any type of structure, including buildings, bridges, sewerage systems, roadways & canals as a primary

effects & water contamination, crop damages, communication disturbance etc as a secondary effects. In the study area those effects & are critically observed. Agricultural Agricultural loss is the main affects of flood in the Ochatul block. About 75% Agricultural lands are located in low lying areas where water logging condition prevails about 3 months. So huge amount of crop damages are found to occurred for flood.

Mud built houses is completely damaged by flood in village areas and concrete houses go under water & sediment deposited over it by flood water. During flood, high speed water flow washes away roads in different locations in Ochatul block and the communication system also breaks down for ~~no~~ few days. The important state high way Ochatul Chandrakona road totally disconnected during this time. Therefore boat is the only way of transport for people & goods also (Das & Bandyopadhyay, 2015).



Plate 2: Submerged concrete houses during flood

Source: <https://timesofindia.indiatimes.com/>

under water during flood for few days. Thousands of people not only Ochatul block but also from surrounding Daspur-1, Daspur-2, Chandrakona-1

block are directly or indirectly depends on this market in different purpose. Those people sale their agricultural products in the Ghatat market every day. So the break downs at transport & marketing system, people are suffered from their daily livelihood. There are 12 Gram Panchayat & 2 municipalities in Ghatat block

More than 80% villages are inundated by flood water in about all the Gram Panchayat & about 8 G.P.s & Ghatat municipality



plate 3: Damage at roads

Source: <https://www.telegraphindia.com>

remains under water for about 2-3 months. More than 15 villages are inundated during flood of some Gram Panchayat, mainly Mohanpur, Ajobnagar, Irbala and Dewanchak 1 & 2. People loss their own habitat in flood as they have to settle temporarily over the river embankments. According to the 50% of the people the people the flood affected in the area is greater than 4 days. Flooding can be very dangerous only 15 cms of fast-flowing water are needed to knock you off your feet! Flood water can seriously disrupt public & personal

transport by cutting off roads and railway lines or completely damaged by flood and an erosion at the selected area. Last four year every year 1.5 to 2.5 km. average road is destroyed by flood at the selected.

River bank erosion put enormous stress to the people who reside along with riverbanks as they lost their homestead, agricultural lands & overall agricultural production. Unfortunately many family or person is affected by flood or shifted of the selected area in last decade as well as communication links when telephone lines are damaged. Floods disrupt normal drainage systems in cities, & sewage spills are common, which represent a serious health hazard; along with standing water & wet materials in the home. Bacteria mould & viruses, cause disease, trigger allergic reactions, and continue to damage materials long after a flood. Floods can distribute large amounts of water & suspended sediment over vast areas, restocking valuable soil nutrients & agricultural lands. In contrast, soil can be eroded by large amounts of fast flowing water, ruining crops, destroying agricultural land, buildings & drowning farm animals (Khan & Das, 2014).

Agricultural land is the vital resource for the people living in study area specially those who live in land, total agricultural production at that particular land & labour force engaged in that occupation. The poor land had less amount of land to support their family. Almost 62 percent of the total population lives on agriculture.

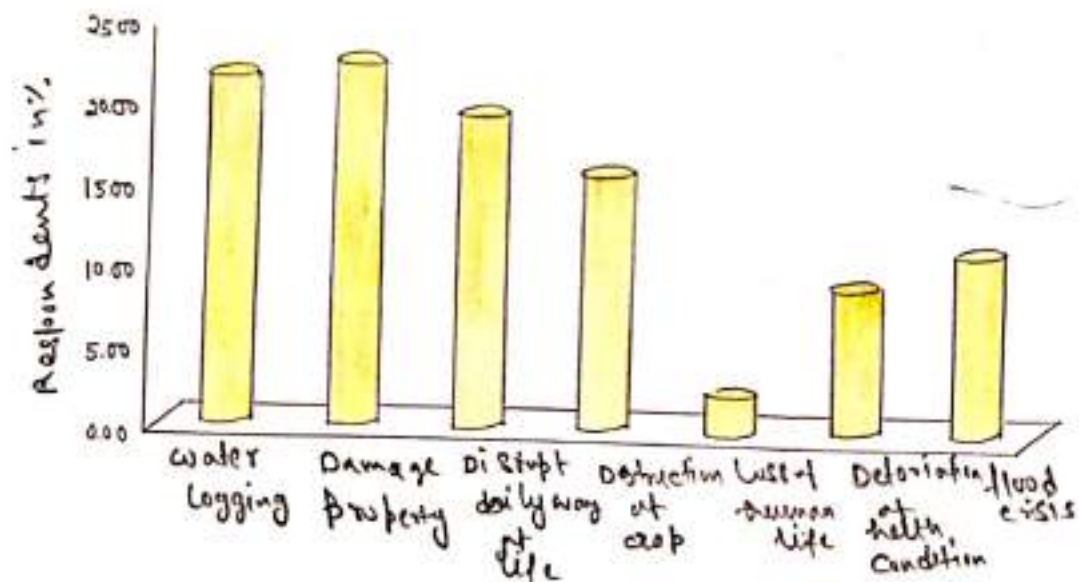


Figure 12: Effect of flood on the respondents

Source: Primary questionnaire survey.



Plate 4: Effect of flood, (A) during flood, (B) post flood.

Source: (A) <https://www.telegraphindia.com>, (B) taken by author. By surveying 100 people in Gehatal they give their opinion about the effect of flood on their socio economic life. The most flood are - it is clear from the water logging is most of the common problem of flood. Gehatal, Pratappur,



Plate 5: satellite image at during flood (A), post flood (B)
Source: Google Earth image

Mohanpur is most affected region in 2017 flood. Damage property is the most common problem at the region. People are adjusted with this situation as they suffered from flood is every year. Human loss is less in Gehatal flood as the government take immediate actions. But due to flood and water inundation for several month leads to deteriorations of health condition of the people and increase the water related diseases in the area. As most of the people are poor or live below poverty line in the study area, their main occupation is mostly agriculture related people do not have enough money to cover up their deteriorate health condition. This leads to fall of health graph of the flood affected people day by day. The people residing in the very proximity of Shilabati River, generally face more problems in accessing drinking water during flooding. 23 percent people in the Gehatal municipality depends on municipal tap water during flooding. 23 percent people in the Gehatal municipality depends on municipal tap water all round the year, but about 54 percent people depends on local tubewell, which during flooding get inundated. Therefore the people have to move to distant areas to access other tubewells even in unhygienic means. Only 23 percent people, mostly in the town areas confirm that they do not face any problem in accessing

drinking water even through flood days. when the flood condition is very high in nature, then nothing is available whether public or private transport. People have to move quite a distance either for ~~maintaining~~ maintaining their regular livelihoods or for their job or education purpose. Most of the houses own Dingi or Donga (small boats) to communicate to some other places during flood situation. Therefore, the use of those boats, forcible changes of route, use of vans, rickshaws, damage to roads are very common during flood time, Actually bus transport totally stops during flood times. As the region comes out from inundation it takes some time to get back to normal condition.

SECTION III

Mitigation:

Flood control refers to all methods used to reduce or prevent the detrimental effects of flood waters. Some of the common techniques used for flood control are installation of rock berms, rock rip-raps, sandbags, maintaining normal slope with vegetation or application of soil cements on steeper slopes and construction or expansion of drainage channels. Other methods include levees, dikes, dams and retention or detention basin. There are two types of measures to mitigate the flood damage: There are two types of measures to mitigate the flood damage: structural mitigation measures and non-structural mitigation measures.

Mitigation by Flood Zonation mapping:

Flood hazard maps are one of the subsets and could be applied as a proper tool in flood basin management so that in normal condition is a guideline for construction of structures and infrastructures and in flooding condition could set the evacuation routes and safe sites. Here a flood zonation has been made by ASTER DEM to show which part of the Gehal subdivision is less than 8 meters, 4 meters, and 2 meters. By zonation properly the area one can find out the area which is more flood prone and take measure according to that.

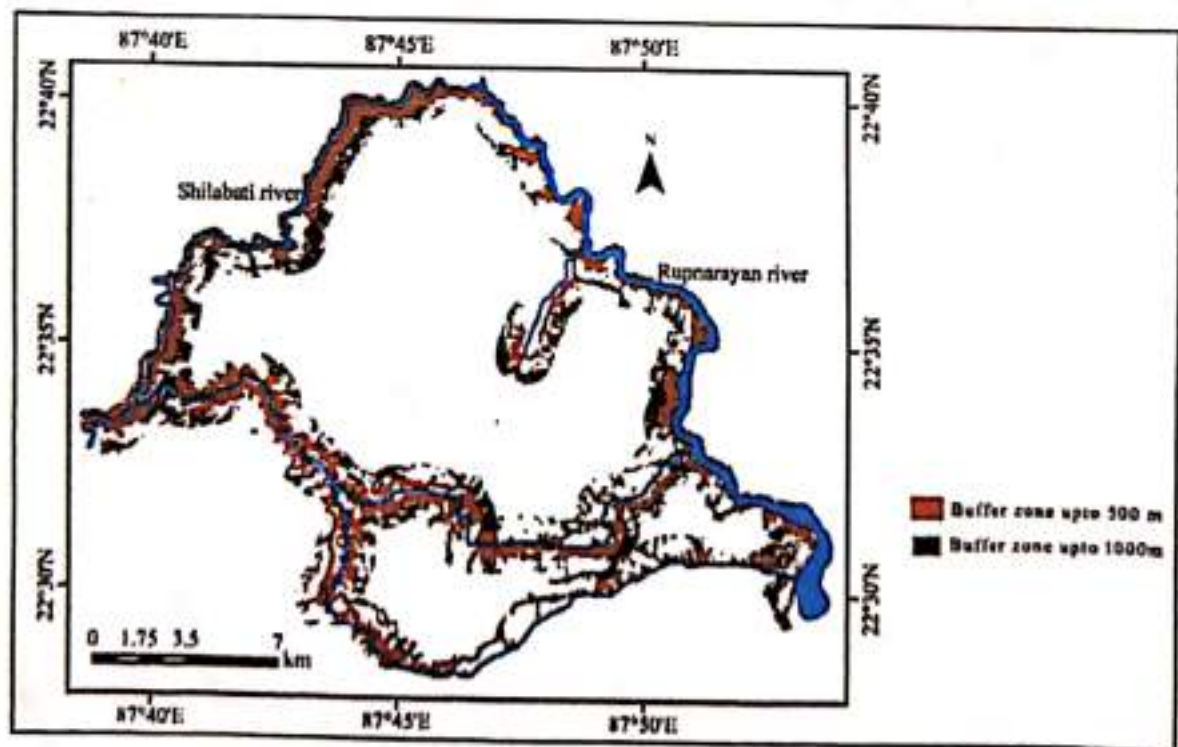


Figure 13: Flood Zonation Mapping of Gehal Sub-division.

In the lower part of the Ghatul sub-division that is in Daspur I Daspur II and in Ghatul block most of the area is under Gmelen. The river bed is higher than the flood plain, that's why water inundated in this zone for a long period of time. The probable mitigation by flood zonation mapping should be done. In the developed country the engineering construction and the built up construction are flowed by the flood zonation or flood hazard map. This should also be done in the developing country like India where flood is the regular phenomenon.

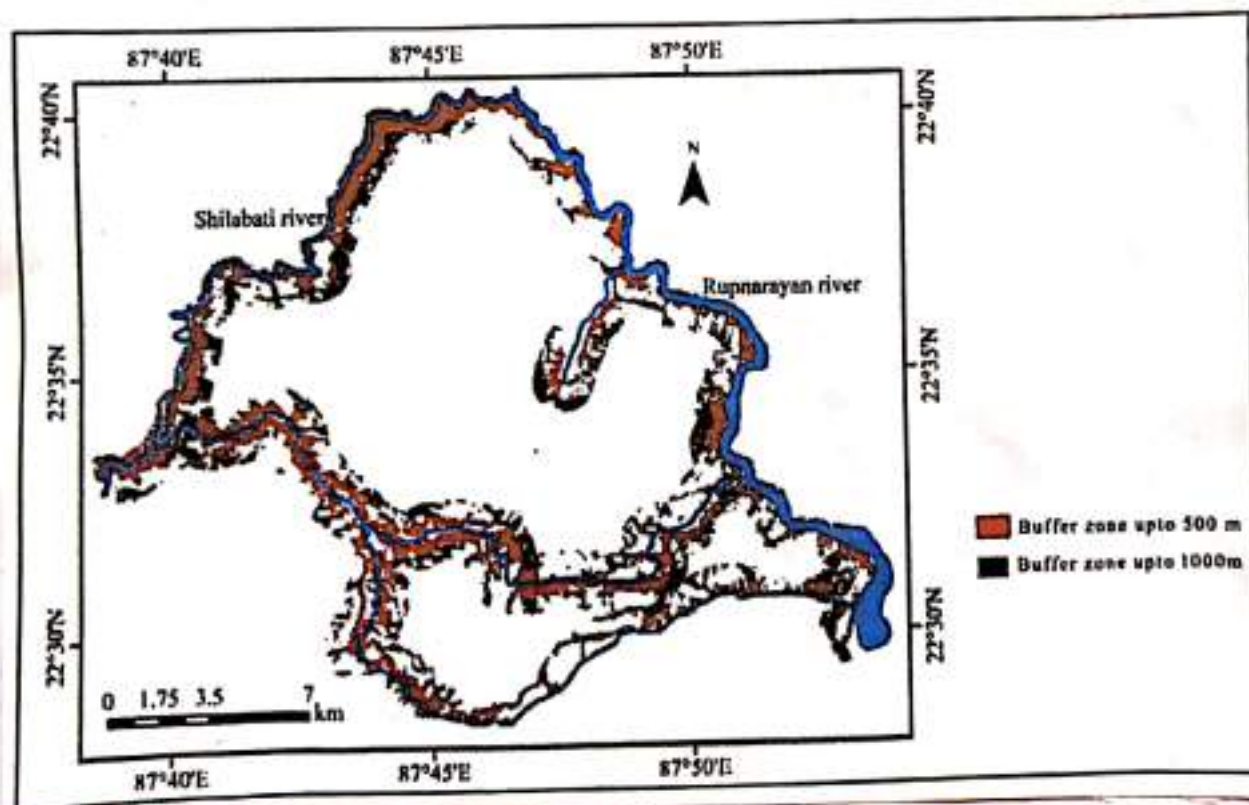


Figure 14: Buffer zone of settlement from river



Figure 15: Area of buffer zone of settlement

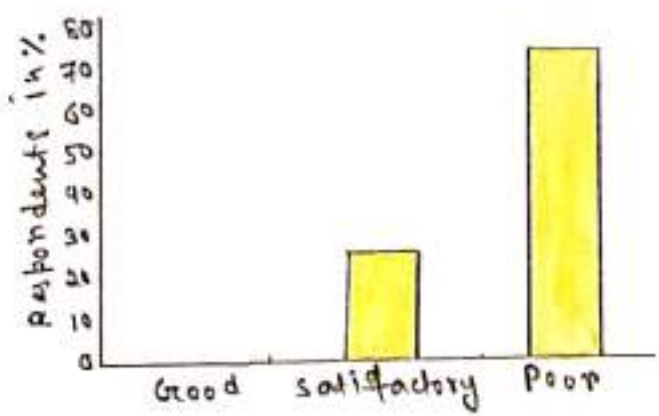


Figure shows that among the total settlement at the flooded zone like between 500 meters and 1 km. from the main river. This gradual growing at settlement makes

Figure 1.6 Satisfactory level at the the flood disastrous because most of the houses lies in the levees and the flood plain. development at built up area should be doing in scientific manner to decrease the loss in flood time.

Municipality co-operation:

By surveying the population it is noted that people's satisfactory level for the municipality co-operation is very low. People thinks that the poor government & municipality work lead to flood in this are. The authority does not take proper flood and post flood mitigation & the main sufferer with be the population. In 2017 the poor embankment condition at Pratabpur leads to massive flood & people suffer from this flood for a year.

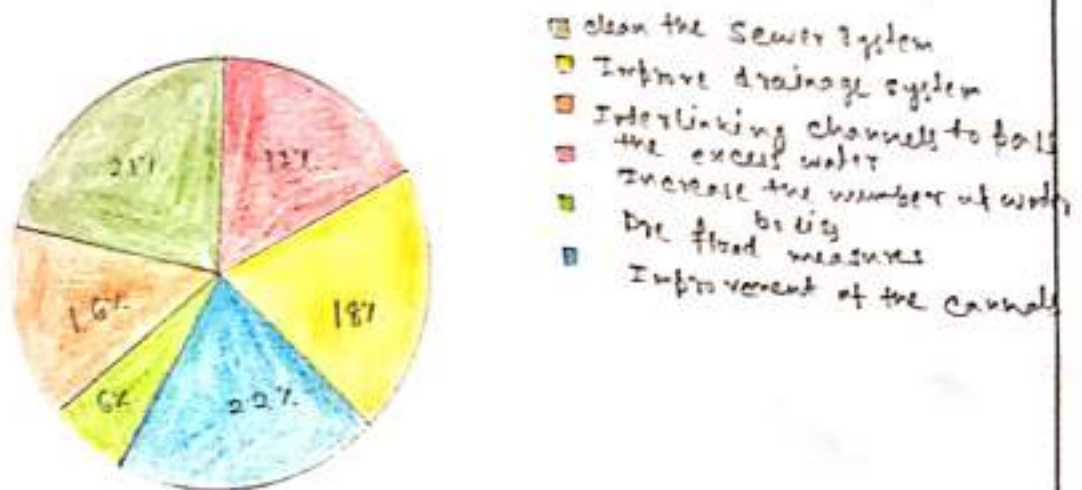


Figure 17: Probable mitigation by the respondents

Most of the people are concerned with the poor drainage system. So, improvement of drainage system in the locality is the main concern. Proper linking between the river & the canal, and the improvements of canal should be taken into concern. The inhabitants of Ghatul are habituated with the flood in every year. They personally take mitigation in the local level by providing flood during flood, providing proper shelter during flood, providing their shelter, but government & municipality should also take some scientific measure to decrease the flood in the study area.

Some other measurement to prevent flood:-

- Proper reservoir improvement for collecting the excess water in flood peak time.



- Concretization of the embankment of the is needed. Most of the embankment at

Ochatal is earthen. They could not prevent the excess flood water during the high intense rainfall. Concretization at the flood water to come in the flood plain zone.

plates: Earthen embankment at Ochatal. Source: Taken by author. They could not prevent the excess flood water during the high intense rainfall. Concretization at embankment with will prevent

- One of the major structural mitigation for flood wall. The flood wall should be made beside the left & right bank of Shilabati, old cossey & Rupnarayan river.



plate 7: Relief from Government in the flood time

- Most of the channel in Ochatal are improper used of the people.

Source: <https://www.telegraphindia.com>

Proper channel development should be taken by the governmental authority.

- creating proper diversion of the excess flood water should be taken. The flood plain of this area is very low than river bed & that's why the flooded water become stagnant for a year. Proper channel diversion can decrease the flood in the study area.
- Construction of higher earthen platform in low-lying flood prone area to match with the higher river bed should be created.
- channel improvement should be done by deepening widening straightening the channel. These change in the river channel increase the flood conveyance capacity of the river. These channel improvement is supplement by bank stabilization by constructing ripraps, dykes or super & planting deep root trees on embankment.
- The shilabati river has a long history of its development, but since its development to its flow, huge accumulation of sediments are found in the channel bed, specially in the lower reaches. To increase the water carrying capacity of the river, even in the monsoon, the river should be dredged in regular basis.

- Proper flood forecasting during pre flood situation should be done, by this people can take proper shelter during the flood time.

Ghatal master plan:

The carrying capacity at SW Labati River is 650 cms which is inadequate to carry the flood water. After a comprehensive study from 1970 to 1976, W.B. Irrigation & water ways department proposed a plan to mitigate the flood and drainage problem which water ways department proposed a plan to mitigate the flood and drainage problem which is known as 'Ghatal Master Plan' (GMP) & in 1976 plan was approved by W.B. Government. In 1982, 10 February the foundation stone of the project was laid down but that was not implemented. In 1997, again the project was newly prepared & for the estimated cost has been approved 20.82 crores but it was not successful. ~~for that estimated cost has been~~ Considering the physical & socio-economic condition of the region the central Govt. authorised the responsibilities for preparing a reliable plan to subordinate organisation water & Power Consultancy Services (WAPCOS). WAPCOS showed the estimated cost for this project in two reports Rs. 1466 crores & Rs. 1740 crores in the year at 2009 and 2011 respectively.

The project area is criss-crossed by a number of rivers and their tributaries & distributaries and also man-made drainage channels have old embankments either on one or both sides, which have become weak & vulnerable. Large areas in Daspun - I & II & Gehatal Blocks were waterlogged for days during the floods of July 2017. Suffering from the handicap of being located at the downstream end of three major river sub-basins, i.e. Kangsabati, Shilabati & Dwarakeswar & having a very flat terrain slope with low level pockets, easement of drainage congestion in the area has always been a major challenge.

The major programmes of Gehatal Master Plan are:

- Re-excitation of rivers and channels, i.e. old & new Gossyee river, Kanki.
- River, Shilabati river, Palaspai, Durbachati, Chandreswar & Solutopakhali &
- Improvement / reconstruction of appurtenant embankments which is 147 Km. long.
- Construction of pump houses at Gehatal Municipal area.
- Construction of major regulators at outfall on Narayani Khal & on Kanki river.

- Retaining wall like structure on left bank at silabati to protect Ghatal Municipal.
- Area from flood spill ~~from~~ for about 2 Km.
- widening at waterway at existing bridge and construction of new bridge.
- cluster of works in Kherai - Buxi Dapalnage scheme.
- Improvement of right embankment of Kangsabati river at selective stretches.
- construction of dwarf wall on top of embankment, where raising of embankment
- Parishad.

In GMP Ghatal block, Daspur I, Daspur II should give more emphasize as they are the most flood prone area. The process of Ghatal Master plan ^{should} started because this will prevent the study area from flood.

SECTION IV

Conclusion:

Flood in Gchatal sub-division is not a new phenomenon. From 8th century the flood occur in Gchatal. From the above discussion it is clear that the major cause of Gchatal flood is its physiographic condition, that is low lying flood plain, high rise river bed & intense rainfall in monsoon. The flood affected people are mainly poor & live below poverty line. It hampers the socio economic & daily life of the people. It also hamper the economic condition at the study area. The people & the government should take care of this situation positively. The programmes for flood mitigation should be taken both by state government & central government. Gchata Master Plan should immediately start in to protect the area from flood. People have to more aware during the flood & flood forecasting should be provided by the government.

References:

A CHRONOLOGICAL RECORD OF NATURAL CALAMITIES IN WEST BENGAL (2017, November 15)

A CHRONOLOGICAL RECORD OF NATURAL CALAMITIES IN WEST BENGAL. Taylor & Francis.

Bhattacharyya, A. (2013). EVALUATION OF HYDRO-ECONOMIC CHARACTERISTICS OF FLOOD IN THE MAYURAKSHI RIVER BASIN OF EASTERN INDIA 3-6.

Das, B., & Bandyopadhyay, A. (2015). Flood Risk Reduction of Rupnarayana River, towards Disaster Management - A case study at Bandar of Ghatol Block in Gangetic Delta. *Geography & Natural Disaster*, 1-10.

Jha, V., & Bairagya, H. (2013). FLOOD AND FLOOD PLAINS OF WEST BENGAL, INDIA: A COMPARATIVE ANALYSIS. *Revista Geo-Araguaia*, 2-5.

Kar, N. S., & Das, S. (2014). A Geographical Analysis of Flood vulnerability in Ghatol Region. 1-6.

Mandal, K. P. (2015). TOURISM, ENVIRONMENT AND ECONOMY - A CASE STUDY IN THE DISTRICTS OF PURBA MEDINIPUR AND PASCHIM MEDINIPUR, WEST BENGAL. 10-15.

Merz, B., Kneibich, H., Schwartze, R., & Thielen, A. (2010). Assessment of economic flood damage. *Natural Hazards and Earth system Sciences*, 2-3.

Mollah, S. (2013). FLOOD HAZARD IN MURSHIDABAD DISTRICT OF WEST BENGAL: AN ENVIRONMENTAL APPRAISAL. 1-3.

(2017). NOTE ON ANALYSIS OF CRITICAL INFRASTRUCTURE KOLKATA: GOVERNMENT OF WEST BENGAL, IRRIGATION & WATERWAYS DEPARTMENT.

Seyf, S., Ahmadi, M., Shirinyade, P., & Sadeghi, M. (2011). Flood Hazard Map in Urban Areas Located on Alluvial Fans. Urban Flood Risk Management (UFRIM), (pp. 1-3). Graz, Austria.

Siegrist, M., & Grunzschler, H. (2008). Natural Hazards & Motivation for Mitigation Behavior: People cannot predict the affect Evoked by a Severe Flood. Risk Analysis, 5-9.

<http://www.wbiwd.gov.in/index.php/applications/dailyreport>.

~~APPEND~~

APPENDIX 8Cause & Effect of flood in ghatal, west Bengal

Place: _____

Sl. No. —

Date: _____

1. Name:
2. original resident yes/no
3. If no, name of town/village
- Residing since - birth / 50 years / 25 years / 10 years / 5 years / less than 5 years.
4. The problem of flooding - (new/old) phenomena
5. was your property affected by flooding? (yes/no)
6. How frequently frequently the flood occurs? (6 months / once in a year)
7. what was the duration of flooding? (< 15 days / 5-10 days / > 10 days)
8. Did the water enter your house? (yes/no)
9. If yes which areas of your house were flooded?
basement / kitchen / bathroom / garden / utility / other.
10. Did you have to move out from your place when the flood occurs? yes/no
11. where did the water that entered your property come from? roads / manholes / grass area / neighbours property / other.

12. The rate of building of new construction - increase / poor.
13. Drainage system at your locality - good / satisfactory / poor.
14. Problems regarding drainage - lack of drainage / irregular cleaning / others.

perception of causes of flood

- > excess rainfall
- > poor drainage
- > rapid urbanisation & construction
- > less carrying capacity of Silabati River
- > release of excess water from dam
- > Lack of municipality facilities
- > others
- > don't know

perception of damage by flood

- > water logging
- > drainage water bodies
- > damage property
- > Disrupt daily way of life
- > no reply

15. Damage intensity due to flood - increased/decreased/
don't know
16. Any mitigation taken by the respondent - yes/no
17. If yes, - _____
18. The role of municipality regarding the mitigation -
good / satisfactory / poor.
19. mitigation by municipality -
- > clean the sewer system
 - > improve drainage system
 - > Interlinking channels to pass excess
water
 - > increase the no. water bodies
 - > others. _____
20. People's awareness about flooding - aware / not
aware / used too.
21. Future flood prediction - it will increase/
it will decrease / it will be more hazardous/
don't know.
22. Any comment: