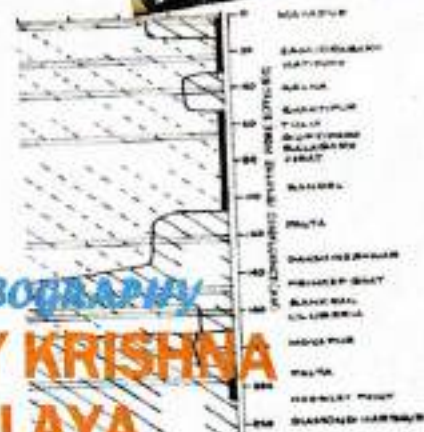


RIVER BANK EROSION AND ITS ANTHROPOGENIC IMPACT ON HUMAN SOCIETY OF CHADRA MOUZA, HOOGHLY DISTRICT, WEST BENGAL



DEPARTMENT OF GEOGRAPHY
BALAGARH BIJOY KRISHNA
MAHAVIDYALAYA



THE UNIVERSITY OF BURDWAN



THE UNIVERSITY OF BURDWAN

UNIVERSITY ROLL NO -190140200043

REGISTRATION NO- 201901037953

**GEOGRAPHY (B.A)
SEMESTER- VI
CORE COURSE-DISASTER
MANAGEMENT (CC-14)
SESSION-2019-22**

DECLARATION

I declare that this written submission represents my ideas in my own words and where others ideas or word have been included, I have adequately cited and referenced the original Sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/ Data/ fact/ source in my submission. I understand that any violation of the above will be cause for disciplinary action by the institution.

Name: JOYEETA KARMAKAR

Roll No: 190140200043

Registration No: 201901037953

Date: 16.06.2022





Telephone: (03231) 260288
Mobile: 9679272229
Website: www.bbkcm.in
Email: bbkcm_hooghly@rediffmail.com
bbkcm.hooghly@gmail.com

BALAGARH BIJOY KRISHNA MAHAVIDYALAYA

P.O.-BALAGARH DIST-HOOGHLY WESTBENGAL-712501

NAAC ACCREDITED

CERTIFICATE

This is to certify that Mr/ Miss JOYEETA KARMAKAR
bearing Roll No. 190140200043 And Registration No.
201901037953 a final semester student of B.A in
Geography Hons course under The University of Burdwan, has completed
successfully his/ her project work with my consent.

B2 16.06.2022

(Subhashis Biswas)
Department of Geography
Balagarh Bijoy Krishna Mahavidyalaya



Jirat, Hooghly.

Dated:

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ACKNOWLEDGEMENT

I would like to express my special thanks of grateful to my teachers of department of geography Mr. Subhashis Biswas and Ms. Debapriya Ghosh Express my deep sense of gratitude of the member of somrha village, Mr. tanru Chatterjee, For his valuable information about the somrha village. I would like to Thank Sri. Subhashish Biswas, my colleague who helped me much in the field and extended co-operation much in all respects a complete the works a success and all those inhabitants of somrha village who have immensely co-operated me at time of conducting at the field survey.

Joyeeta Kazomakar
16.06.2022

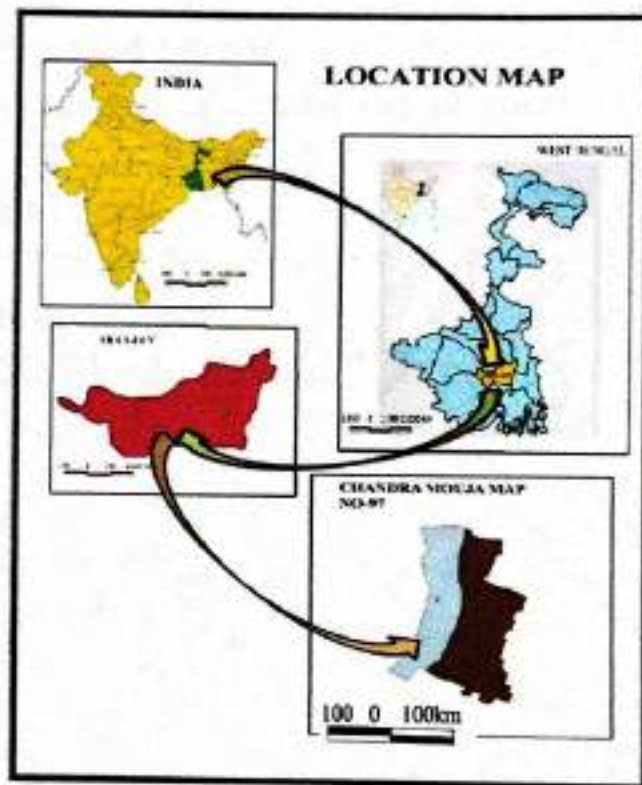


INTRODUCTION

The Ganga, the river of India, after the long Eastward journey through the north India plains, enter the West Bengal of eastern India passing by on its right bank as outlay of Rajmahal hill and flows about 72 Km. from Rajmahal to Farka barrage about 40km. downstream of frack barrage it's get divided by two branches. one of them Bhagirathi hooghly which flows about 500km South word to reach the Bay of Bengal. The other branches flow about 60km. Along India Bangladesh border and finally enter the Bangladesh with the name of Padma. Ganga enters west Bengal to Rajmahal and flows in 207kms through eighteen community developments blocks. After that it headed to sea in 290km. To the south flowing the district of Hooghly. It is generally known that meanders are oscillated during the last few hundred years cause erosion of sifting river bank. The present study endeavoured to address the aspects by building a digital database and manually on bank erosion problem and shifting the river Ganga last ninety years from 1921-2011.

STUDY AREA

Our study area is along the both side of river Bhagirathi from Chandra to Sukariya in Hooghly. Extended up to $23^{\circ}07'688''N$ - $23^{\circ}07'891''N$ and $88^{\circ}27'070''E$ - $88^{\circ}27'765''E$. It consists as Balagarh block. Argo based economy has been developed in this area. the river bank erosion and shifting the river had a great impact upon the people lived here. So, it has necessary to keep to eye the changing patterns of physical and cultural settings in this area.



OBJECTIVES

The specific objectives of the present study are to:

- * Identify the channel bank segments based on erosion intensity.
- * Evaluate the nature of erosion.
- * Identify the causes and problems of bank erosion.
- * Build erosion map and shifting of river.
- * To documents the people struggles to rebuild their home's and reorganize their family life.

METHODOLOGY

The whole process study may be divided into three distinct steps of Morden methodology like-

- *Pre-filed preparation
- *Filed investigation
- *Post filed work

PRE-FILED PREPARATION

The pre filed activities based on the study of previous literature to understand the cause, process and patterns of river bank erosion. Before going to the field i collect published and unpublished data. relevant information compiled by the different organisations concerned (BDO Office, BLRO Office, Agriculture office in Balagarh block) were consulted.

FILED INVESTIGATION

We collect different year top sheet map of Chandra and its surrounding areas. Google Earth and DPMS Maps in Hooghly district and data. And capture some erosion spots future of left & right bank deposition Chandra at Bhagirathi and collect a primary data and others evidence.

POST FILED WORK

The collect data and maps have been presented by manually and computer technic. Map have been prepared by

comparative study of the image and toposheet. To find out the pattern of changing and shifting the river course.



RIVER BANK EROSION AREA

PHYSICAL SETTINGS OF HOOGHLY DISTRICT

SOIL

Hooghly district mainly cover by the different types of soil like deep loam, Sandy, antiholes etc. Covered by antisolsustiflvents and alfisoils and lateritiekulti soils has sown the middle part of Chandra.

CLIMATE

The district of Hooghly enjoys of moderate climate. the maximum temperature is 39°-40° C and minimum temperature 12°-18°C. The annual rainfall month varies to 1400mm-1700mm. Here we can saw the study area intensity rainfall is high.

RELJEF AND SLOPE

The geomorphology or Hooghly district is a mature delta and the slope of land is less than 10 meters more or less plain. The slope of land is east to west. The slope of several part between more than 10meters less than 5 meters. There is also diversity and elevation.

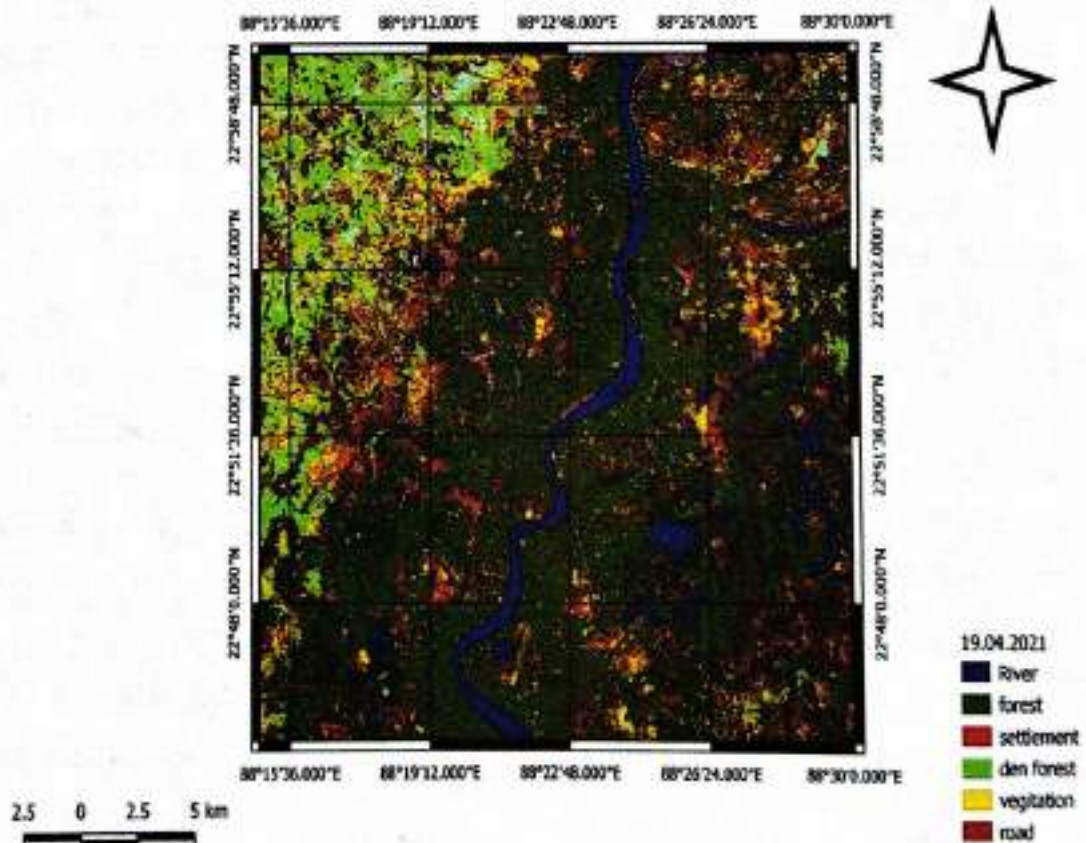
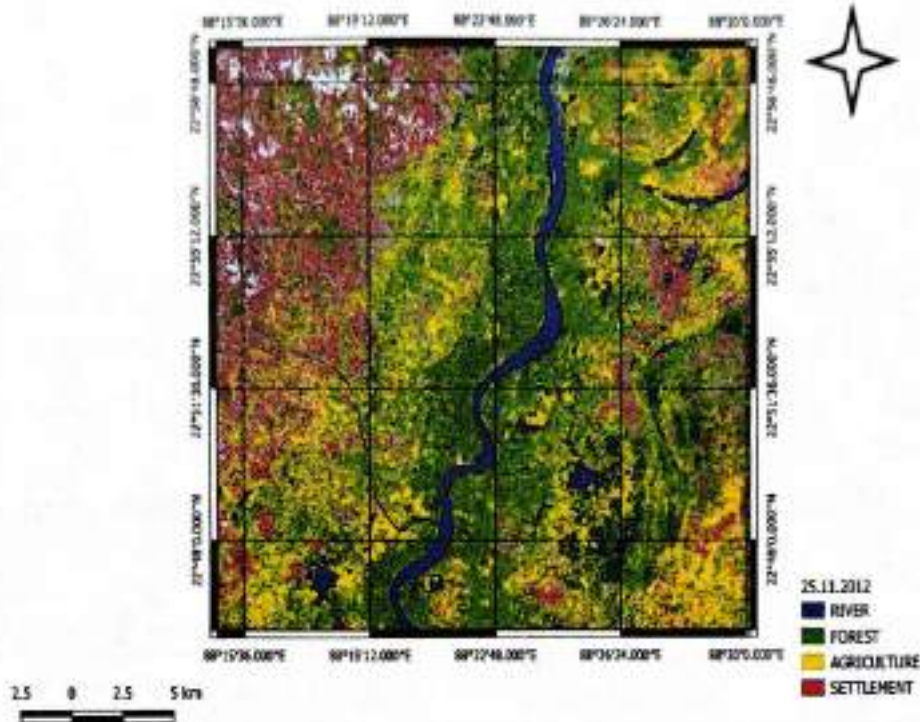
GEOMORPHIC PROCESS OF BANK FAILURE

Near Chandra, the Ganga erodes mainly right bank. At this area this stratigraphy of the bank composed of unconsolidated micaceous sand at the bottom and silt-clay upon it, appears to be responsible for the process bank erosion. The erosion along the bank of Ganga is the phenomenon of the monsoon months (June to September) and it has too distinct.

phases:

Pre flood and post flood erosion. The peak discharge of the river may be to the tune of 1238.68 cumec, as was observed in September 2011. The first moving current during the rising stage of discharge in monsoon months removes unconsolidated sediment from theses of the shelving bank which ultimately collapses. The post flood erosion is related to the effluent flow of ground water into the river. This occurs during the falling stage of the discharge. The flow of ground water toward the river leads to liquefaction and flowage of basal sediment of the bank. However, in both cases a linear crack, often 10 to 20 meters in length develops along the bank and the edge of the bank collapse into the river along the line.

LAND USE LAND COVER MAP (UNSUPERVISED)



CONTEXT AND RATIONAL COUSE OF RIVER BANK EROSION:

The hazards of bank failure and related fluvial geomorphic events are found to be Occurred mainly as a result of interaction among the factors like (a) Liquefaction, (b) helical flow (vertical circular motion of water) towards the concave banks sides thus attacking the bottom of the bank, (c) formation of alternate layers of silt, clay and sand, (d) fluctuating flow discharge particularly s-w Monsoon periods. (e) Anthropogenic impact especially human intervention and soon in and around the sites as above.

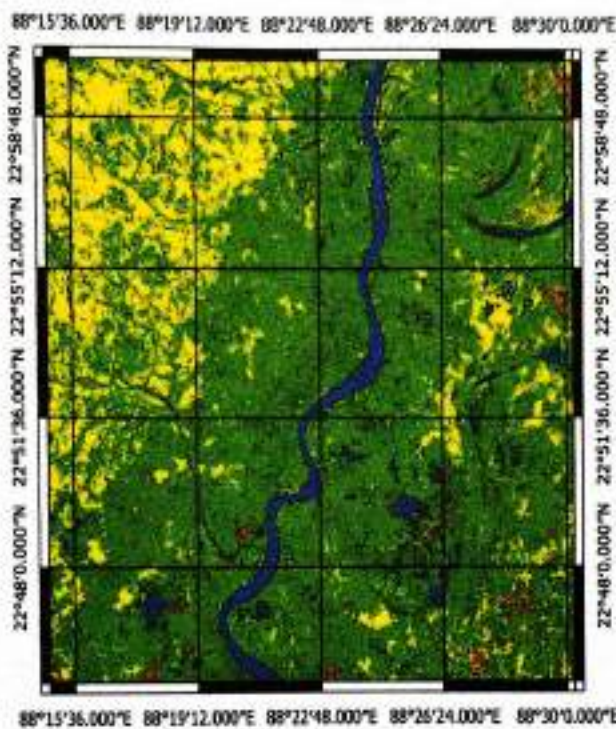
Bank Failure:

The bank failure along the lower reach of the Ganga is a recurrent phenomenon experienced during June to October every year. While the pre-flood erosion is cause by shearing of current along the bottom of the shelving bank, the post-flood erosion is dominated by the process of liquefaction and flowage. The stratigraphy of the bank which can best be observed along shelving cliff facing the river, during the pre-winter season, made it vulnerable to erosion. The river starts to erode it bank when the discharge exceeds a critical value and the shear stress surpasses the resistance offered by the bank forming sediments. During the rising stage of the hydrography, undercutting along the base of the shelving cliff leads to the development of linear cracks or fissures on the flood plain. The underlying sand strata being less cohesive, is rapidly eroded by the fact current and bank slums along the fissures.

Bank Caving:

Similar to Bank failure the bank Caving is also found to be associated with the hazards of bank erosion. As this process is repeated the channel Migrates downstream in the flood plain tract. In doing so the swinging course of the river is brought into contact with the valley side bluffs which are themselves very gradually cut back, there by widening the valley. In time the valley sides will be eroded back in this fashion to produce a broad, virtually flat surface at the expense of the interfluvial areas, a process. In connection with the problems of river bank erosion it seems necessary to present some points on some aspects of river bank. Here it denotes mainly the margin of a river channel, beyond which lies the flood plains both the upper flood plain & lower flood plains and further it includes the valley of the river. Normally, a vertical bank is formed where fluvial corrosion being very active and operate strongly by the water flow. These are found to be evolved on the outside of a curve under the process of undercutting. Thus, resulting in the Occurrence of slump or collapse of the constituent alluvial materials into the river beds.

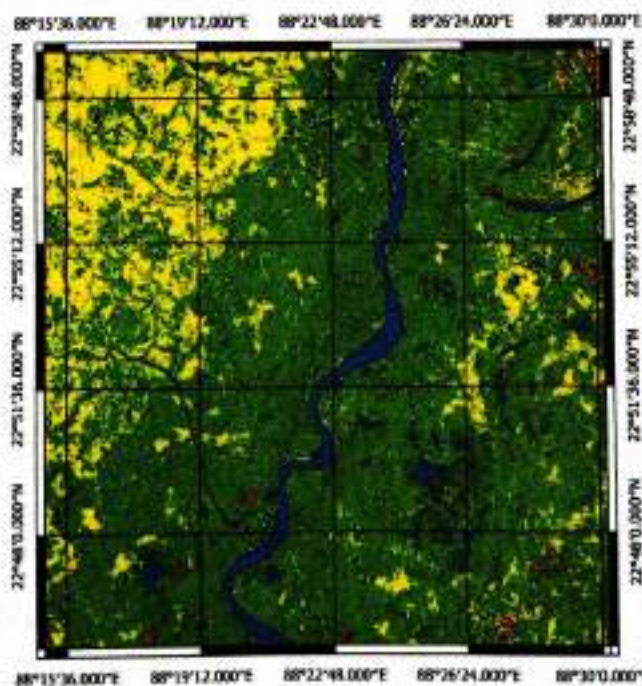
LAND USE LAND COVER MAP (SUPERVISED)



25.11.2012

- 1 - WATERBODY
- 2 - FOREST
- 3 - AGRICULTURE
- 4 - SETTLEMENT

2.5 0 2.5 5 km



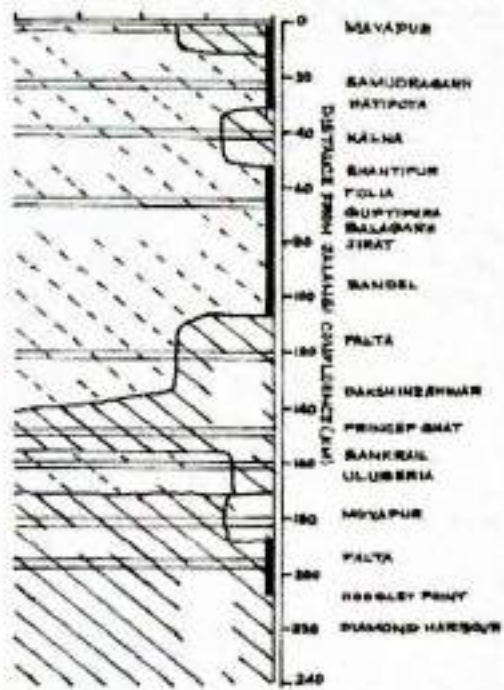
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- 1 - WATERBODY
- 2 - FOREST
- 3 - AGRICULTURE
- 4 - SETTLEMENT

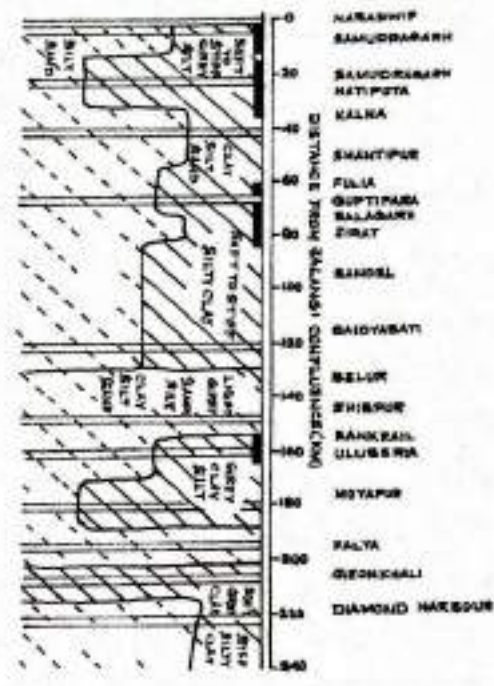
2.5 0 2.5 5 km



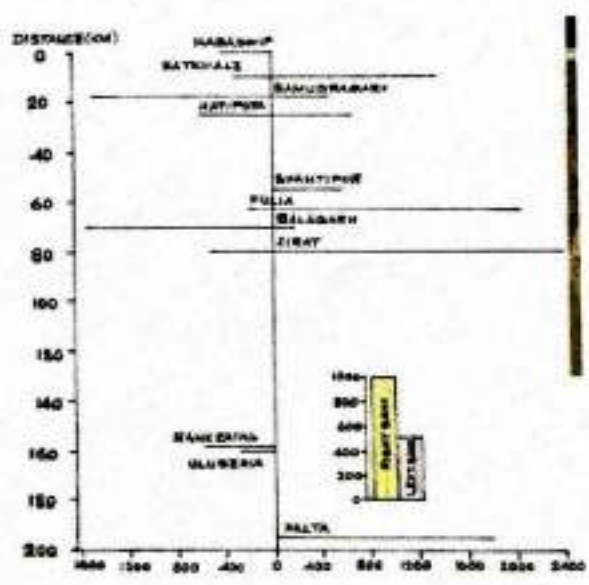
BANK EROSION AND SOIL PROFILE OF THE LEFT BANK OF RIVER HOOGHLY



BANK EROSION AND SOIL PROFILE OF THE LEFT BANK OF RIVER HOOGHLY



ERODED AREA: BOTH SIDES OF RIVER HOOGH



SPILL CHANNEL EVOLUTION AND BANK EROSION

It seems necessary to special effects spill channel evolution broadly a river when in excess of its flow i.e., beyond its capacity cannot load water within its bank and spill in the adjoining areas. The excess water trying to find a new passage of drain .it may in either in the form of sheet folding or it try to new passage through the water discharge which are called spill Channel these are some types of distributers. The bed level is raised and during the heavy forests, water over tops enters within spill channel which are endive lend. There are numerous examples such a spill channel of shoot. In centre Bengal Jalangi, bahira, mathabhanga are main spill channel of ganga. A river does not flow along its course for long. The processes of avulsion, bank failures, bank erosions as well as soil erosions and river shifting are found be associated with the spill channels.

ERODED AREAS DUE TO DUE TO SHIFTING OF GANGA RIVER COURSE

From the three satellite we can say that there is a significant change in the river course of river Ganga in Chandra at Balagarh, Hooghly during 1921-2011 is ganga eroded of both bank of Chandra area. But of the rate erosion is left bank more than right bank about 3.39 sq. km 5.05 sq. km and deposited 4.50sq.km 1.60 sq.km at the same bank of particular region has also convenience bank of river. We can see that the meandering ganga river increase gradually and conclude that river Ganga is eroding his right bank its Chandra and shifting towards the west.



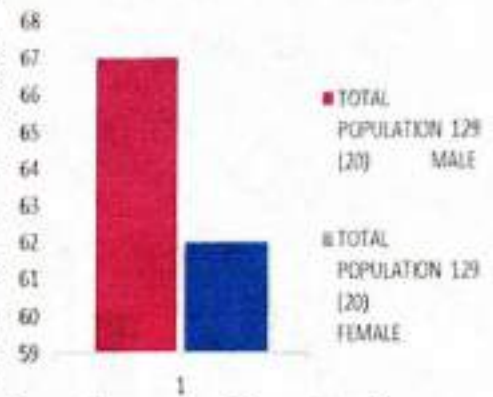
RIVER BANK EROSION MANAGEMENT

DEMOGRAPHIC STATUS

There is large no of people lived together in our study area among them 51.9% male and 48%female.

Which really shows an inequality on the society. Most of the people of this are age between 10-40 years and the number of people aged 50years less so it is quite good for the young as they don't have the burden of large no. Of working population. Most of the people of this area are of schedule caste 60% and only 30% people belonged general caste. there the ST and OBC people also lived in this area.

TOTAL POPULATION

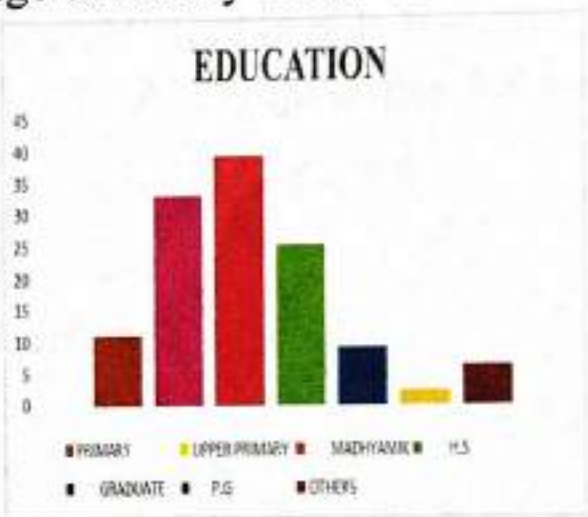


AGE SEX



EDUCATION

The people are of our study not educated enough as only 97% person are literate and 3% person are illiterate. There is also a steep difference of education level between male population and female population. That is a village area only 2.3% woman are literate and 1% men are illiterate. Which is more than the double for the women literacy percentage. If we go through the education level of this area, we can see around 17% people just get a primary an education and 6.9% people had a chance complete their secondary education. Besides these the people had completed their H.S education. Graduation and post-graduation are only 3% 5% and 2% respective.



EDUCATION BY SEX



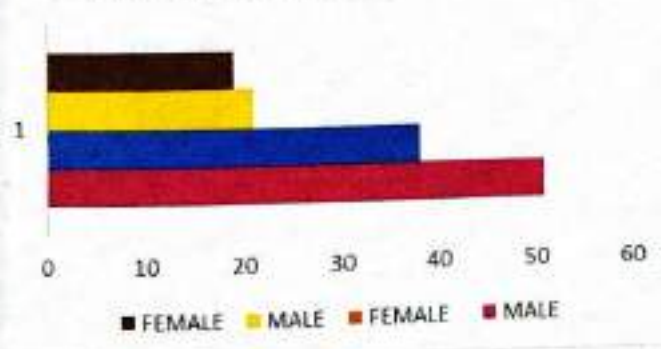
ACTIVITY

The people of study area mainly villagers and their activities related to the primary activities labour, weaver, fishermen etc. Around 71% people engaged is different type of work which in 51% people are men. Though most of the people likes traditional works but other occasions now also been prepared. practice of feminine dropping now days also land in our study one eroded very rapidity for the primary data the economic conditions in this area. Therefore, a great no of people lived land of the Indian railways. Though Indira Abasyojana has helped these people to get their own house

WORKER

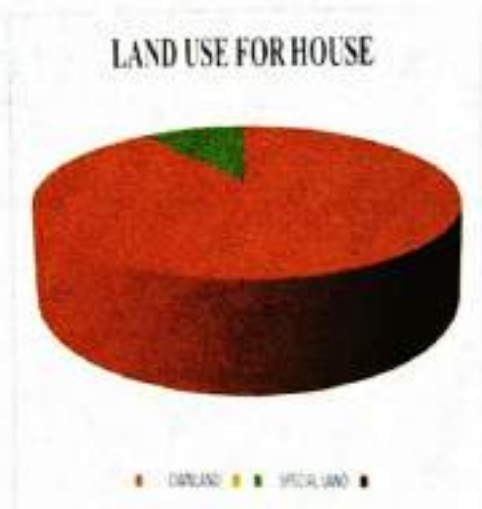
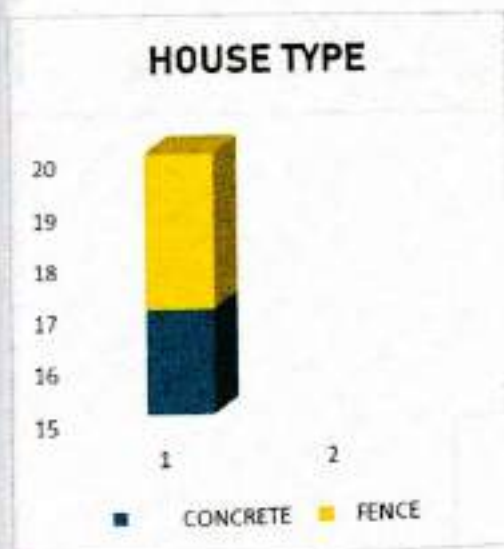
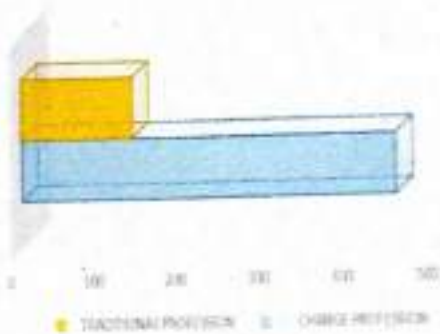


WORKER & NON-WORKER POPULATION

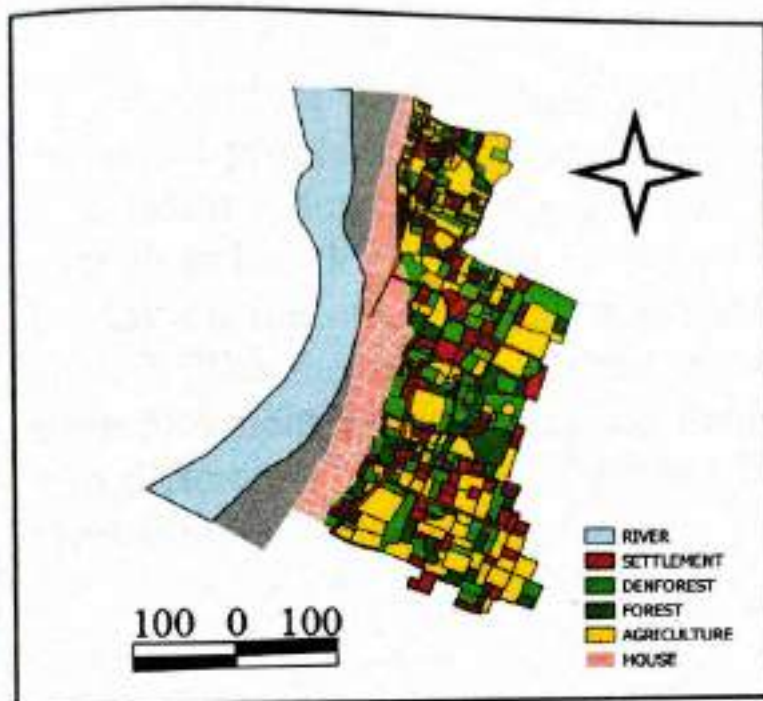


CHANGING PROFESSION

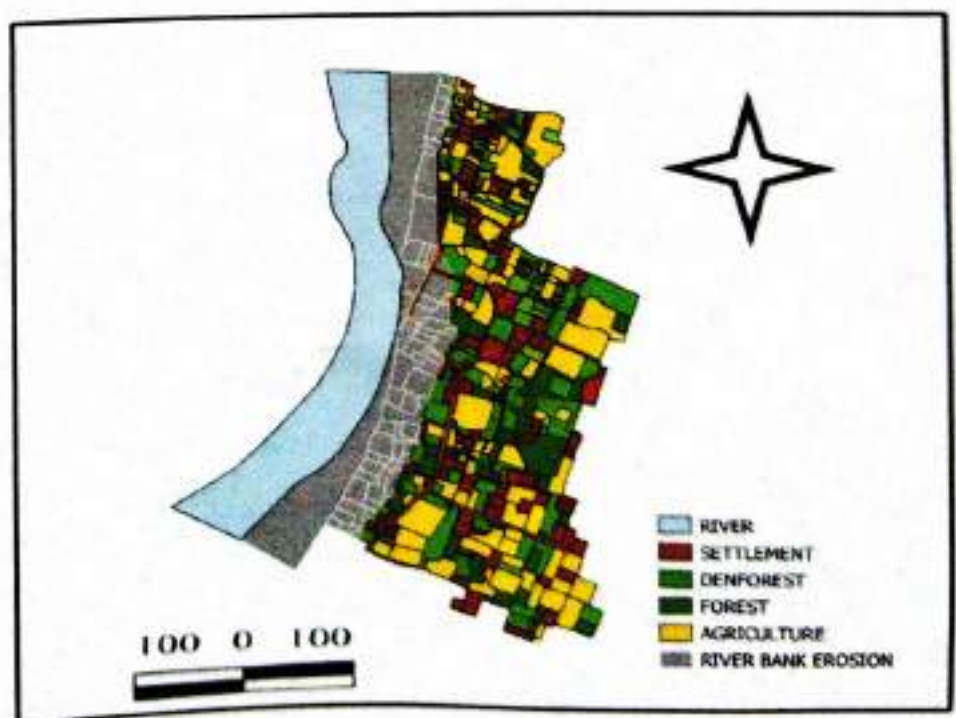
Around 76.9% people of this area forced to change their occupation due to the erosion of shifting to river channel. Most of the people engaged in farming and working as a daily labour. As the river shifting to much after the year 1975. The amount fish in the river has been decreasing as a good rate, so these fishermen lived on this occupation now having a great trouble.



**CHANDRA MOUZA (J.L.NO.97)
LANDUSE MAP
PREVIOUS SURVEY REPORT (IN 1994-97)**



**CHANDRA MOUZA (J.L.NO.97)
LANDUSE MAP
RECENT SURVEY REPORT
(IN 2022)**



PEOPLE'S PEACIONS

According to the inhabitants of this area the most underestimated problem of this area is river erosion earlier the Govt. Had taken a few steps the reckless Erosion but that was not enough to handle the situation. So, people become homeless day by day on the other Hand, people also think that they had not enough like the source of drinking water, water logging and unemployment problem. Helped them they could not engaged into different type of illegal actives like the soil cutting by the river side.



RIVER BANK
EROSION SITE



TEMPORARY RELIEF SHELTER
OF EROSION EFFECTED PEOPLE

CONSEQUENCE

The Bhagirathi River banks Along our study area has beneficng erosion. About 3.35km² in the right side and 3.05km² in left side bank has been eroded the year. The area which submerged in to the Bhagirathi are mainly agriculture and residential area. Thus, people have to shifting from their he Mel and at times. It has also seen that there has shifting of river ground 15-20m in every year. The S. E Railway tracks are in danger because of the river flowing just 50km away. The threat is the 6 no stage highways also not very from the river. Therefore effected 500-700 families have to move towards mainland. So, the people become homeless. The cultivation land is also disappearing very fast due to the erosion.



MITIGATION OF RIVER EROSION

In regard to the question of river mitigation, Bio-engineering can possibly offer a solution. It is low-cost river bank protection, easy to contract, using natural and local materials, so that will harmonies with environment. Use of vetiver to control of floodplain erosion has been tasted at some locations in India. In other places a combination of bamboo, vetiver and Ipomeacarnia has been used to protect riverbank attack by currents of river. The

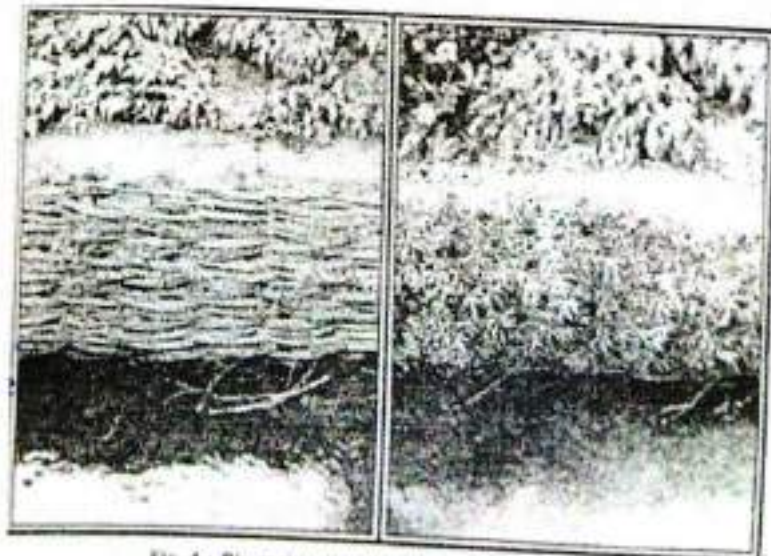


Fig. 4 : Bio-engineering for Stream Banks Protection

effect is the slumping of the banks. Some low-cost river bank protection methods have been used in some developed countries. One method has been to lining the banks with some stone, if there is local source of rock. The pits in stones and nooks and crannies between them increase the amount of area for colonization by aquatic insects. Plants can take root between the rocks and rock ledges. These are used as resting and rooting sites by waterfowl. Relatively permanent option is to use sufficiently large stones that are not washed away during high flows. More angular stones with interlock and thus provide greater stability. Placing a layer of fine gravel or stone under the larger riprap material from beneath the rocks.

To avoid undermining at the toe can be use of stone aprons, which extend well out into the riverbed. An extra pile of rock can be added to the edge of the apron, which fall inland continue protecting the bed if it degrades. Spurs, groins or bank mantles are structures extend out from a streambank into the flow. These are many used to reduce the speed or change the direction of the stream's current thereby reduce the erosive force of streams. Then there are many designs to use timber planks or logs bolted to posts. With proper design, silt gets deposited in the quiet water between the ground. Vegetation can be planted in these silt beds which will eventually form floodplain benches. Normally, a series of groins are used along a bank. Vertical timber posts or pile driven vertically into the stream can be used to protect the lower part of a bank especially where a cliff on the meander bends exists. In areas where the pruning and brush cutting is practiced, the woody debris can be recycled to protect the stream bank. But these should be anchored with wooden posts. Debris can be also be used to slow down water, trap silt and sediment and permit the growth of aquatic plants. Smaller material can be woven together for bank protection. Stakes are driven into the ground and branches woven between them. Alternatively, posts can be staggered in two rows and brush piled between them. If available in the neighbourhood, use of Willow stakes can create a

semipermanent barrier to protect the bank. Vetiver grass is a crop very easy to grow. This can grow at various level of fertility of land in wet and dry conditions. These do not need maintenance. Leaf, blade, root and also young plant grow in dense formations. Its root grows vertically downwards more than 3m, so that is into competing with other crops. Vetiver grass over 10 years. The vetiver grass does not yield not yield seed or rhizomes

CONCLUSION

There is a huge amount of money is waste for the purpose of bank erosion protection. So, we need holistic and positive approach to tackle the bank erosion problem. To prevent the bank erosion engineers, suggest to burden boulders on the surface on the bank. That is why the stress gradually increases on the upper portion of the bank. As the bottom surface of the bank at this area is composed of unconsolidated sand materials, so over stress and gravitational force accelerate the failure of bank. So, to prevent the bank failure and save human property the engineers should be taken proper techniques

APPENDIX

TOTAL POPULATION 129 (20)

MALE	FEMALE
67	62

AGE SEX

AGE GROUP	X	FEMALE	CENTER	MALE
0-15	09-jan	9	2	11
15-30	05-jan	13	2	15
30-45	00-jan	18	2	22
45-60	07-jan	11	2	16
>60	11-jan	7	2	5

EDUCATION BY SEX

LITERATE		ILLITERATE	
MALE	FEMALE	MALE	FEMALE
66	59	1	3

EDUCATION LEVEL

PRIMARY	UPPER PRIMARY	H. S	GRADUATE	P. G	OTHERS
11	39	25	9	2	6

WORKER & NON-WORKER POPULATION

MALE	FEMALE	MALE	FEMALE
51	38	21	33

TYPES OF WORKERS

FARMER	LABOUR	WEAVER	BUSINESSMAN	SERVICEMAN	OTHER
23	28	1	13	4	1

INCOME

RS/MONTH	NO. OF FAMILY
3000	1
3001-10000	10
10000-25000	7
>25000	2

HOUSE TYPE

CONCRETE	FENCE
17	3

PERCEPTION STUDY OF MAJOR HAZARD

EROSION	20(1)
FLOOD	20(2)
WATER LOGGING	4(4)
DRINKING WATER	14(3)
WORK	13(5)

The University Of Burdwan



THE TROPICAL CYCLONE AMPHAN

University Roll: 190140200128
Reg. No: 201901038041 of 2019-20
Semester: VI
Paper: CC-14
Paper Name: Disaster Management



DECLARATION

I declare that this written submission represents my ideas in my own words and where others ideas or word have been included, I have adequately cited and referenced the original Sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/ Data/ fact/ source in my submission. I understand that any violation of the above will be cause for disciplinary action by the institution.

Name: *Shibu Dm.*

Roll No: *190140 200128*

Registration No: *201901038041 of 2019-20*

Date: *16/06/2022*



Telephone: (03231) 260288
Mobile: 8670272239
Website: www.bbkm.in
Email: bbkm_hooghly@rediffmail.com
bbkm.hooghly@gmail.com

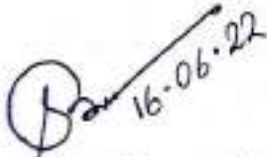
BALAGARH BIJOY KRISHNA MAHAVIDYALAYA

P.O.-BALAGARH DIST-HOOGHLY WESTBENGAL-712501

NAAC ACCREDITED

CERTIFICATE

This is to certify that Mr/ Miss Shibu Das,
bearing Roll No. 190140200128 And Registration No.
201901038041 of 2019-20 a final semester student of B.A in
Geography Hons course under The University of Burdwan, has completed
successfully his/ her project work with my consent.


16-06-22

(Subhashis Biswas)
Department of Geography
Balagarh Bijoy Krishna Mahavidyalaya

Jirat, Hooghly.
Dated:



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ACKNOWLEDGEMENT

This study had found help, support and guidance from different people from the beginning to end .I would like to express my special thanks of grateful to my teachers Associated professor of Department of Geography Mr. Subhashis Biswas, Associated professor of Department of Geography Ms. Debapriya Ghosh, in Balagarh Bijoy Krishna Mahavidyalaya. I would also like to thanks to my parents and classmates for their valuable guidance and continuous encouragement during this report. I express my deep gratitude to the media for their information during this report.



PREFACE

I am presenting a project file on the topic of "The Tropical Cyclone Amphan". I have tried to give all the important points to give topic. I am thankful to everyone who all supported me to complete this project on time.

I am equally thankful to my Geography teacher who gave me a moral support on time. He also guided me in different matter regarding this project. While doing this project I come to know many things.

ABSTRACT:

Both hazard and disaster have a detrimental effect on people's lives. Cyclones wreak havoc on human life in a short period of time. People lose their and become destitute. Almost every year cyclone hit West Bengal. Cyclones like Amphan has caused extensive damage to West Bengal and Odisha. Recent Amphan has caused extensive damage to West Bengal, Odisha, and south india.



INTRODUCTION

Super Cyclonic Storm Amphan was a powerful and catastrophic tropical cyclone that caused widespread damage in Eastern India, specifically in West Bengal and Odisha, and in Bangladesh, in May 2020. It was the strongest tropical cyclone to strike the Ganges Delta since Sidr of the 2007 season and the first super cyclonic storm to have formed in the Bay of Bengal since the 1999 Odisha cyclone. It was also the fourth super cyclone that hit West Bengal and Kolkata since 15 as well as being one of the strongest storms to impact the area.[1][2][3] Causing over US\$13 billion of damage, Amphan is also the costliest cyclone ever recorded in the North Indian Ocean, surpassing the record held by Cyclone Nargis of 2008.[4]The first tropical cyclone of the 2020 North Indian Ocean cyclone season, Amphan originated from a low-pressure area persisting a couple hundred miles (300 km) east of Colombo, Sri Lanka, on 13 May 2020. Tracking northeastward, the disturbance organized over exceptionally warm sea surface temperatures; the Joint Typhoon Warning Center (JTWC) upgraded the system to a tropical depression on 15 May while the India Meteorological Department (IMD) followed suit the following day. On 17 May, Amphan underwent rapid intensification and became an extremely severe cyclonic storm within 12 hours.

On 18 May, at approximately 12:00 UTC, Amphan reached its peak intensity with 3-minute sustained wind speeds of 240 km/h (150 mph), 1-minute sustained wind speeds of 270 km/h (170 mph), and a minimum central barometric pressure of 920 mbar (27.17 inHg). The storm began an eyewall replacement cycle shortly after it reached its peak intensity, but the continued effects of dry air and wind shear disrupted this process and caused Amphan to gradually weaken as it paralleled the eastern coastline of India. On 20 May, 12:00 UTC, the cyclone made landfall in West Bengal. At the time, the JTWC estimated Amphan's 1-minute sustained winds to be 175 km/h (110 mph). Amphan rapidly weakened once inland and dissipated shortly thereafter.

Coastal areas in West Bengal comprising East Midnapore, North 24 Parganas, South 24 Parganas, Kolkata, Hooghly and Howrah as well as Odisha were affected by the cyclone. It also caused significant destruction in Bangladesh.

OBJECTIVE OF THIS STUDY

- The purpose of this project is to find out where the impact of the cyclone is in West Bengal, Odisha the extend of the damage.
- This project has helped to understood for impact of super cyclone
- The financial condition of all the states in India affected by the cyclone and the financial condition of West Bengal,Odisha
- The joint efforts of the Central government and State government to deal with the aftermath of the cyclone will be known.



METHODOLOGY

On May 17, a low-pressure area formed in the Bay of Bengal. On the next day, at 09:30 UTC, the disturbance intensified into a depression and was assigned the designation BOB 02 by the India Meteorological Department (IMD). Meanwhile, the JTWC issued a Tropical Cyclone Formation Alert at 15:00 UTC on May 18 on the developing system.

On 18 May, at approximately 12:00 UTC, Amphan reached its peak intensity with 3-minute sustained wind speeds of 240 km/h (150 mph), 1-minute sustained wind speeds of 270 km/h (170 mph), and a minimum central barometric pressure of 920 mbar (27.17 inHg). The storm began an eyewall replacement cycle shortly after it reached its peak intensity, but the continued effects of dry air and wind shear disrupted this process and caused Amphan to gradually weaken as it paralleled the eastern coastline of India. On 20 May, 12:00 UTC, the cyclone made landfall in West Bengal. At the time, the JTWC estimated Amphan's 1-minute sustained winds to be 175 km/h (110 mph). Amphan rapidly weakened once inland and dissipated shortly thereafter.

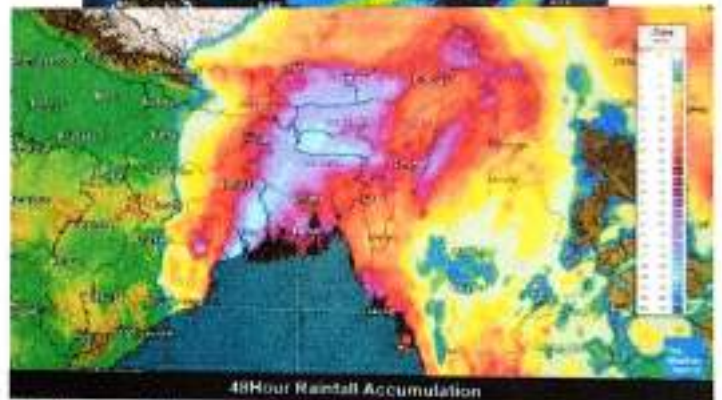
ENVIRONMENTAL CONDITION

Rainfall:

The India Meteorological Department's weather monitoring station at Alipur in Kolkata recorded exceptionally high rainfall of 236 mm over the last 24 hours from Wednesday morning to Thursday morning. Similarly, the Dum Dum area in the city of joy also received 200 mm rainfall, while Salt Lake area witnessed 183 mm on Wednesday. Incidentally, the Kolkata district had received only 185 mm of rainfall in 80 days from March 1 till May 20, before the cyclone hit the city.

Wind warning:

On 18 May, at approximately 12:00 UTC, Amphan reached its peak intensity with 3-minute sustained wind speeds of 240 km/h (150 mph), 1-minute sustained wind speeds of 270 km/h (170 mph), and a minimum central barometric pressure of 920 mbar (27.17 inHg). The storm began an eyewall replacement cycle shortly after it reached its peak intensity, but the continued effects of dry air and wind shear disrupted this process and caused Amphan to gradually weaken as it paralleled the eastern coastline of India. On 20 May, 12:00 UTC, the cyclone made landfall in West Bengal. At the time, the JTWC estimated Amphan's 1-minute sustained winds to be 175 km/h (110 mph). Amphan rapidly weakened once inland and dissipated shortly thereafter. Bengal's east Medinipur, south and north 24 Parganas, Howrah, Hoogly and Kolkata districts and Odisha's Jagatsinghpur, Kendrapara, Bhadrak, Balasore, Jajpur and Mayurbhanj districts are likely to be worst-hit by the cyclone.

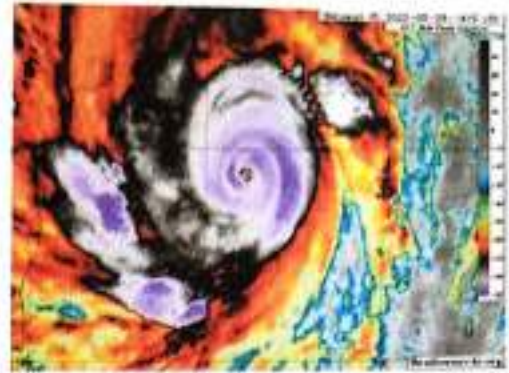


Sea condition:

Amphan is also the costliest cyclone ever recorded in the North Indian Ocean, surpassing the record held by Cyclone Nargis of 2008.[4]The first tropical cyclone of the 2020 North Indian Ocean cyclone season, Amphan originated from a low-pressure area persisting a couple hundred miles



(300 km) east of Colombo, Sri Lanka, on 13 May 2020. Tracking northeastward, the disturbance organized over exceptionally warm sea surface temperatures; the Joint Typhoon Warning Center (JTWC) upgraded the system to a tropical depression on 15 May while the India Meteorological Department (IMD) followed suit the following day. On 17 May, Amphan underwent rapid intensification and became an extremely severe cyclonic storm within 12 hours.



Fishermen Warning :

Home Minister Amit Shah on Tuesday (May 19) spoke to Naveen Patnaik and Mamata Banerjee, the chief ministers of Odisha and West Bengal, the two states which are expected to take the maximum hit of super cyclone Amphan, and assured them of all help.

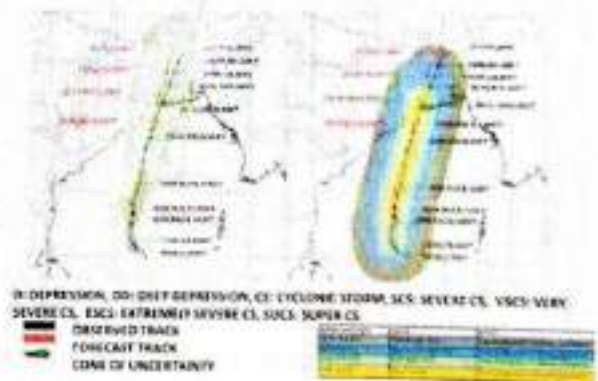
Meanwhile, rain lashed some parts of Odisha on Tuesday as the cyclone moved closer to the coasts. In the morning, Amphan lay centred over west-central Bay of Bengal, about 520 km south of Paradip (Odisha), 670 km south-southwest of Digha (West Bengal) and 800 km south-southwest of Khepupara in Bangladesh, said HR Biswas, the director of Meteorological Centre, Bhubaneswar.

He said it is likely to weaken in to an extremely severe cyclonic storm, move north-northeastwards over Bay of Bengal and cross West Bengal-Bangladesh coasts between Digha and Hatiya Islands during Wednesday (May 20) afternoon or evening with maximum sustained wind speed of 155-165 kmph gusting to 180 kmph.

The India Meteorological Department (IMD) has issued a warning to fishermen in both the states to suspend all fishing activities till May 20.

Storm surgewarning:

The Indian Meteorological Department warned of a storm surge of up to 4-5 meters above astronomical tide that is likely to inundate low-lying areas of West Bengal during landfall, and of about 2.5 - 3.5 meters for Bangladesh.



IMPACT OF AMPHAN

India

The effects of Cyclone Amphan in India were extensive and historic. Cyclone Amphan was the costliest tropical cyclone ever recorded in the North Indian Ocean, and the strongest cyclone ever since the 1999 Odisha Cyclone. It was the first storm, and strongest of the historic 2020 North Indian Ocean cyclone season, the costliest recorded cyclone season. It made landfall in West Bengal with 100 mph winds. Within India, the storm killed 98 people, and caused \$13.8 billion (2020 USD). Amphan produced extremely high winds that ripped roofs off houses and uprooted trees, and storm surges of 15 ft (4.6 m) in areas like Digha, West Bengal.



Areas affected: West Bengal, Odisha, South India.

Winds: 3-minute sustained: 155 km/h (100 mph)

Duration: May 20 – 21, 2020

Damage: \$13.5 billion

West Bengal

The coastal districts recorded an estimated gusts of 180 km/h (110 mph).

In Kolkata, reports of car being overturned, trees uprooted and downed power lines caused into havoc. Some parts of the city remained without power. The streets were waterlogged and trees blocking the roads. Some districts got power in the middle of the night after the storm had passed. The airport was remained shut and became waterlogged, many structural damages were reported.[29] Chief Minister Mamata Banerjee even stated that "a bigger disaster than Covid-19".[28] Netaji Subhash Chandra Bose Airport, Kolkata, recorded highest wind speed of 133 km/h on 20 May 2020. Other parts of Kolkata experienced wind speed of 110–130 km/h.



Odisha



Although the state have escaped the worst part of the cyclone, it caused significant impact in the Odisha–West Bengal border districts. It affected 4.5 million people in the state. Due to high gust winds and intense rainfall, districts like Bhadrak and Kendrapara suffered especially for the paddy farmers since the paddy fields became unsuitable for paddy cultivation which was inundated by saline water due to storm surge. According to the Odisha Government, 3 million people remained without power due to power outage and it took a while to return to normalcy whereas the roads were being cleared by the National Disaster Response Force (NDRF). In Mahakalapada and Rajanagar, around 500 acres (200 ha) of lands were destroyed also because of saline water ingress and hundreds of acres of rabi crops were destroyed in Balasore and Bhadrak district.

In the Dharma Port, an estimated wind speed of 120 km/h (75 mph) was recorded while Paradip recorded only 100 km/h (60 mph).

DAMAGE EFFECTED FOR COASTAL DISTRICTS OF NORTH ODISHA, WEST BENGAL

- Total damage from the cyclone worth Tk1,100 crore.
- Around one crore people in the south-western and north-western regions have been left without electricity.
- The cyclonic storm caused around 60% network towers (13,000 in number) of the region to be cut off the power supply.
- Coastal areas of Satkhira, Bagerhat and Patuakhali were affected most among 26 districts that were hit.
- 1,100 kilometres of roads, 200 bridges and culverts were damaged.
- 150 kilometres of embankments in 84 places have been either damaged or completely broke.
- Water that broke through the embankments affected 1,80,500 hatcheries. Financial loss worth Tk325 crore.
- The cyclone damaged mangoes worth approximately Tk150 crore.
- 6 kilometres of embankments and 763 hectares of crops destroyed in Bhola.
- Amphan weakens into storm, signal lowered at ports.
- So far 20 people were killed in different districts of Bangladesh.
- At least 72 people have died in India's West Bengal due to cyclone Amphan, said the state's Chief Minister Mamata Banerjee.
- Cyclone Amphan leaves Kolkata Airport flooded, structures damaged

AFTERMATH OF AMPHAN:

International Relief

German NGO Welthungerhilfe released 100,000 Euro to fund Cyclone Amphan relief efforts.



West Bengals

Prime Minister Narendra Modi making an aerial survey of Cyclone Amphan affected areas of West Bengal on May 22, 2020.

Prime Minister Narendra Modi held a review meeting after the aerial survey of the Cyclone Amphan affected areas of West Bengal, in Basirhat on May 22, 2020.

On 22 May, Prime Minister Narendra Modi conducted an aerial survey over Kolkata, along with Chief Minister Mamata Banerjee.[43] Modi announced a ₹10 billion (US\$132 million) immediate relief package for West Bengal and ₹5 billion (US\$66.2 million) in relief for Odisha. In advance, Modi announced that ₹200,000 (US\$2,650) would be provided to the next of kin of people who died during the storm, and ₹50,000 (US\$660) would be given to each injured person. West Bengal CM Banerjee stated that it would take three to four days to assess the damage. Twenty disaster relief teams were dispatched by the Indian Coast Guard to begin search and rescue operations. Ten teams were sent to West Bengal to aid recovery, in addition to the NDRF teams pre-positioned there before Amphan's passage. Also since most of the water pumps are operated in electricity and due to no electricity, several district suffered from water shortage which caused additional protest. Approximately 1,000 ground teams worked to restore infrastructure and services in West Bengal after Amphan, though only 25–30 percent of workers were staffed due to the COVID-19 pandemic. The resulting slow restoration of power sparked protests across West Bengal aimed primarily at electricity company CESC. Some restoration efforts were disrupted by these protests. The Home Department of West Bengal requested additional crews from railway and port interest, while five brigades from the Indian Army were

deployed in Kolkata and the 24 Parganas districts to support recovery efforts. The government of Odisha sent 500 members of its disaster rapid action force and fire service to West Bengal.

The European Union stated that it would initially provide €500,000 (US\$545,000) for those affected by the storm in India.

Odisha

Additional assistance was requested from Jharkhand and Odisha.[49] Odisha Chief Minister Naveen Patnaik performed an aerial survey of the damage in his state following Amphan.



MANAGEMENT OF CYCLONE AMPHAN

A super cyclone "Amphan" developed in the Bay of Bengal in mid of May, 2020 caused massive destruction to eastern India especially West Bengal & Odisha. National Disaster Response Force (NDRF) deployed its self-contained rescue & relief teams in the coastal areas of West Bengal & Odisha in view of Cyclonic Storm 'Amphan'.

20 NDRF teams were deployed in the coastal areas of Odisha like Balasore, Jagatsinghpur, Jajpur, Kendrapara, Puri & Bhadrak. NDRF teams worked day & night to bring the normalcy and proved its worth by removing 515 uprooted trees, 30 Electric Poles and cleared 354.5 Kms of road. Teams also assisted State administration in mass evacuation of more than 2.37 lakh people to safer places.

38 NDRF teams were deployed at coastal areas of West Bengal like Kolkata, Nandigram, Kontai-1 Block & Digha, (East Medinapore), Arambagh (Hooghly), Uluberia & Domzur (Howrah), Sandeshkhali, Hasnabad & Hingaljanj (24 Pargana, North), Pathar Pratima, Naamkhana, Gosaba, Kakdweep & Sagar Island (24 Pargana, South) and Rajarhat.

NDRF teams evacuated 7650 livestock to safer places. Teams removed 7392 uprooted trees, 1150 Electric Poles and cleared 3152.5 Kms of road. Teams also assisted State administration in mass evacuation of more than 8.13 lakh people to safer places.



CONCLUSION

Although the path of the cyclone did not hit Cox's Bazar, the effects of the cyclone nevertheless was felt in the refugee settlements in Cox's Bazar, which received heavy rain and strong winds. The Bangladesh Cyclone Preparedness Programme (CPP) raised three flags as an alert sign for refugees in the Cox's Bazar refugee settlements. The three flag was the highest alert level that refugees have seen for a cyclone since many of them first arrived in Bangladesh in 2017. Over 1,252 shelters were partially damaged and 159 shelters completely destroyed, temporarily displacing 144 households. In total, close to 6,000 refugees were affected by the cyclone. (UNHCR, 16 Jun 2020)

According to the rapid assessment report conducted in June 2020 by Indian Red Cross Society (IRCS), in West Bengal, India, 2.9 million houses were reported damaged. There was a need for supply of shelter kits, utensils, tarpaulins, lighting solutions for those who had fully or partially lost their houses. Health facilities damaged in West Bengal by the cyclone included 563 primary health centres, 169 Block primary health centres and 5,142 sub-centres at the community level. The existing health systems were already overwhelmed due to the COVID-19 pandemic, and the damages due to the cyclone made this worse. The waterlogged areas with debris and other waste materials would accelerate the risk of water and vector-borne diseases. (IFRC, 23 Jul 2020)

According to Need Assessment Working Group (NAWG) report dated 31 May, approximately 2.6 million people were affected, 205,368 houses were damaged, 55,767 houses were destroyed in the 19 affected districts in Bangladesh. Total 26 people lost their lives. In addition, 40,894 latrines; 18,235 water points; 32,037 hectares of crops and vegetable; 18,707 hector of fish cultivation area; 440 km of road and 76 km of embankment were damaged. Later in August, due to active monsoon conditions and lack of sustainable repair of embarkment, a strong tidal surge has given rise to the water levels of the Shibsra, Kapotakkho and Koyra in Khulna, rivers causing breaches in the protection embankments in the already disaster-stricken coastal district bordering the Bay of Bengal. Twelve villages in Koyra and Paikgachha upazila, which were already severely damaged by cyclone Amphan and tidal water, have once again been flooded by this tidal surge. Six months after the cyclone, villages in Satkhira, Khulna remain inundated as Water Development Board (WBD) yet to repair damaged embankments. As a result of broken embarkment, around 50,000 people have been severely affected in Koyra and Paikgachha upazilas under Khulna district. At least 15,000 people exposed to serious waterlogging issues. In Satkhira district, 375 acres of land inundated as Kholpetua River breaches embankment and flooding 250 acres of farmlands and fish enclosures in this low-lying villages due to Kopotakkho river embankment collapsed and waterlogged hundreds of families.

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S. D.
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