

Impacts of Tropical Cyclone on Namkhana Block in Sundarbans (West Bengal)

Tapas Naiya¹, Payel Mondal² and Dr.Sankar Prasad Paik*

1# State Aided College Teacher in Geography, Sundarban Mahavidyalaya, Kakdwip,
South 24 Parganas, Pin: 743347

*# Associate Professor, Department of Chemistry, Sundarban Mahavidyalaya, Kakdwip,
South 24 Parganas, Pin: 743347

Abstract:

The Indian Sundarban (cluster of deltas) well-known as the World Heritage Mangrove Forest and the land of great Royal Bengal Tiger. Namkhana block is a smallest part of Sundarban, located at the coastal area of Bay of Bengal and the southern region of West Bengal. Due to the geographical location of Sundarban in India, this deltas land has already faced so many cyclone and the cyclonic storms are the common natural incident. The cyclonic storm, saline water flood, deforestation and river bank erosion are the major problems at Namkhana. The cyclonic disaster brings lot of crisis for the villagers for survive in future. The natural disasters (Cyclones) damage of dwelling houses, and transport, communication system, agricultural lands and crops. The salinizations of the fertile agricultural land are the major problem in post cyclonic effect and before reinstate again facing another natural disaster. Most of the peoples are survives on cultivation and some peoples only depends on fishing and due to damage of agricultural land, crops and salinization of farming land many stakeholders shifted their job from cultivator or fishing to a migrated labor in the other part of the state or country as a result the demographic change can take place. As our college located in sundarban, the southern coastal region of West Bengal; our researcher's team visit the cyclonic storm porn area (Namkhana Block) and presented their collected data's (from the local administrations), survey reports, remarkable after effect photographs and some conclusions in this research article.

KEY WORDS: Deltas, Cyclone, Costal erosion, Migration.

1.1: INTRODUCTION

Sundarban is a vast adjacent mangrove forest ecosystem in the coastal region of Bay of Bengal spread over India and Bangladesh on the delta (world's largest) of the Ganges, Brahmaputra and Meghna rivers. The study area of the Indian sundarban is shown in fig-1.

Generally, the cyclone which is formed with deep low pressure over the sea water of tropical region is called tropical cyclone. Tropical cyclones draw in air from a large area and concentrate the water content of that air into precipitation over a much smaller area. This replenishing of moisture-bearing air after rain may cause multi-hour or multi-day extremely heavy rain up to 400km from the coastline, far beyond the amount of water that the local atmosphere holds at any one time. This in turn can lead to river flooding, overland flooding and a general overwhelming of local water control structures across a large area.

Most tropical cyclones in India develop in the Bay of Bengal, making the eastern coast more prone to cyclones. The states in India that are most affected by cyclones are Odisha, Andhra Pradesh, West Bengal, Tamil Nadu and Kerala. West Bengal has two cyclone seasons, one in April–May and the other in November–December. The pre-monsoon cyclone is known as Kalbaishakhi and can cause widespread hailstorm. The social and economic disaster arise due to the impact of these cyclone, so many muddy houses, electricity poles, agricultural crops, trees were destroyed.

The block of Namkhana is our study area. It is the most important area of Sundarban region. It has an area of 370.61km². It is located at 21.7699°N 88.2315°E. It has an average elevation of 4 meters (13 ft). It has 1 panchayat samiti, 7 gram panchayats, 131 gram sansad (village councils), 39 mouzas and 34 inhabited villages, as per the District Statistical Handbook.

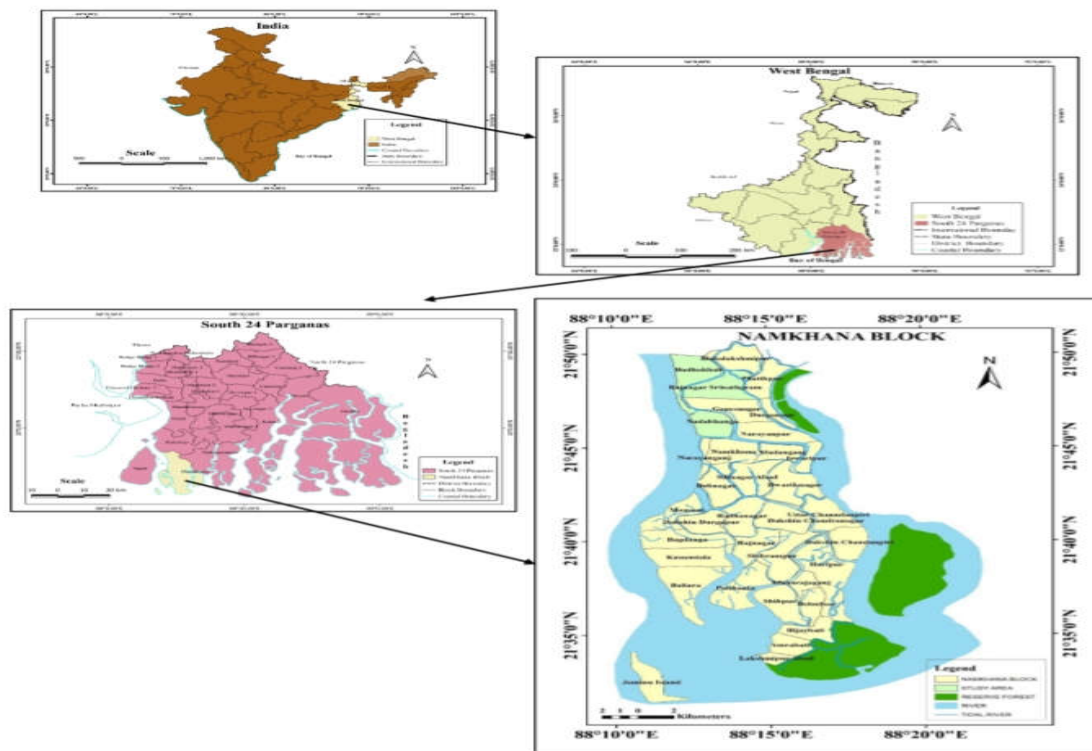


Fig-1: Location Map of the Namkhana Block in South 24 Parganas District.

1.2: SCOPE OF THE STUDIES

Namkhana Block is located near the Bay of Bengal. One or more cyclones hit Namkhana block every year. Due to the high tide during the cyclone, the dams of Muriganga, Hatania Doania Rivers broke and flood salted water entered the neighboring villages of Budhakhali, Nadabhanga, Rajnagar etc area. Almost all residential areas were completely or partially destroyed. So peoples in this area are surviving with the fight against the natural calamities like cyclones. Cyclonic buffer mean, the mangrove land which protect the main land from the

dangerous effect of the landfall of cyclone. Only mangrove forests can act as a cyclonic buffer. The cutting of mangroves by the dishonest hotel businessman and poor wood traders make Sundarban in a dangerous phase as a result of river bank erosion, the overflow of river tidal water in the agricultural land are the common things in the study area.

1.3: METHODOLOGY

Our research work has been performed by three phases.

PRE-FIELD: Studies of the maps, topographical sheets, satellite image of the study areas, basically topographical maps analysis.

FIELD STUDY: The field study involves direct field measurement and observation. Our team and some students of our college visited the area on 23.09.2024

POST-FIELD: Primary data was collected from 120 randomly selected households, through structured questionnaire and interview method from house to house. After collecting primary data through household level survey, tabulation sheets were prepared to collate the data. After preparing the tabulation sheet, group discussion is conducted to verbally analyze the effect of cyclone in Namkhana block. Primary data is not sufficient to understand the impact of cyclones in any region. To complete the report, we have also collected secondary data from various sources, such as the Census of India Handbook for South 24 Parganas, and unpublished official data from Panchayat offices.

1.4 OBJECTIVES OF THE WORK:

- A) Identify the frequency of cyclone since 2019.
- B) To dig out the adverse impacts of cyclone on rural livelihoods.
- C) Identify the relation between cyclone, bank erosion and flood at Namkhana block
- D) Identify the relation between cyclone and agricultural practices.
- E) Identify the Economic effects of high intensity cyclone on villager's life.
- F) Identify and analysis of Environmental effects of high intensity cyclone on villager's life.

1.5 REVIEW OF LITERATURE:

In 2007, the landfall of Cyclone Sidr damaged around 40% of the (Kar & Bandyopadhyay (2015)) Sundarbans. The forest is also suffering from increased salinity due to rising sea levels due to climate change and reduced freshwater supply. In May 2009 Cyclone Aila devastated the Sundarbans with massive casualties. At least 100,000 people were affected by this cyclone. (Hoque. et.al,(2017),[10] The proposed coal-fired Rampal power station situated 14 km (8.7 mi) north of the Sundarbans at Rampal Upazila of Bagerhat District in Khulna, Bangladesh, is anticipated to further damage this unique mangrove forest according to a 2016 report by UNESCO.

Cyclones have severe socio-economic consequences, especially for fishing and agricultural communities. Research by (Krauss. et.al,(2022); Rizwana & Mokbul,(2019); Ghosg.et.al(2018)) highlights widespread livelihood loss due to the destruction of fishing equipment, homes, and crops. Vulnerable populations face long-term economic hardship, with limited recovery support. Cyclone disaster and its impact on rural (sundarban) livelihood: A case study on rural community of Pakhiralaya village at Gosaba Block, South 24 Parganas, West Bengal (Adhikary (2022); Chakraborty,(2023)). According to him, cyclones cause extensive damage to agricultural, land, roads, etc. As a result, the economic structure of these areas is weakened.

2. GEOGRAPHICAL SCENARY OF THE STUDY AREA:

The study area has humid tropical monsoon climatic zone and have a little variation in temperature, rainfall and humidity. The year can be divided into four seasons. The period from March to May is summer. The temperatures in this region rise from daily lows of 2–4°C in winter to 32°C in monsoons and highs of 43°C in March, with a mean annual temperature of 25.5°C (77.9°F). Literature survey reveals that the sea level of the sundarbans has raised by an average of three centimeter per year over the past twenty years (Hazra.et.al,(2002)). The Sea level rise is reducing spawning productivity due to soil salinity inundation, and 40-38 percent of fishing activity is affected by seawater. Sundari, Goran are the dominant mangroves found in the above mention area.. Due to soil salinity, uterine germination is observed in these plants.

3. NATURE AND IMPACT OF CYCLONE DISASTER: HISTORICAL AND SOCIAL VIEWS

The impact of the cyclone is mainly felt in the coastal areas. The effect is particularly noticeable in the Indian Sundarbans due to the warming of the Bay of Bengal. According to research, serious the number of cyclones registered in the Bay of Bengal has increased by 26% in the last 120 years. Parts of the southern Gangetic delta also face the devastating effects of cyclones along with the Sundarbans.

The effects of cyclones like Fani, Bulbul, Amphan and Yass have been felt by the people of Namkhana block and surrounding areas. Cyclone impact has caused damage to houses, loss of life and disruption of vital services like health care in these areas. It also damages electricity, water supply and crops, resulting in food shortages in areas and areas falling behind in every way.

Table-1: Showing data of respective cyclone in Sundarbans.

CYCLONE	DATE	SPEED	ORIGIN	LANDFALL
Fani	3rd MAY,2019	205km/h	Indian Ocean west of Sumatra	Between Satapada and Puri

Bulbul	5th Nov,2019	130km/h	Andaman Sea and Bay of Bengal	Indian Sundarbans
Amphan	20th May,2020	175km/h	Bay of Bengal	Bakkhali
Yass	25th May,2021	140km/h	Bay of Bengal	Balasore

4. IMPACT OF CYCLONE

Cyclones are the most destructive natural disasters. Which negatively affect the environment and human life in the Namkhana block of the Sundarbans. In the last six years, the villages of Budhakhali, Rajnagar, Nadabhanga etc. along the river banks of the Namkhana block have been severely damaged. The impact of cyclones has caused loss of life, livelihood and property of people. The impacts are discussed in the different angles as below

4.1. PHYSICAL IMPACT

DAMAGE TO MANGROVE FORESTS: Mangroves protect the Sundarbans from the effects of cyclones, but the extent of mangrove forest decreasing due to the influence of recent cyclones. For example, in 2020, Cyclone Amphan destroyed 28 percent of the mangroves in the Sundarbans.

RIVER COURSE CHANGE: The cyclone eroded the bottom of the river's concave bend, changing the river's course. In addition, due to the influence of storms, strong tides in rivers transport rocks and soil from one place to another, forming new land forms, which in turn changes the course of the river.

SEA LEVEL CHANGE: The high tides caused by cyclones are eroding the Sundarbans embankments. This is causing the sea level to rise by 3-8 mm every year. This is causing the soil salinity in the coastal areas of Namkhana block to increase.

EROSION OF VARIOUS COASTLINES: Recently, the number of cyclones has increased in the Sundarbans. Due to the impact of cyclones, tidal water hits the coastline, which erodes the coastline (**Fig-2**) and carries away soil, stones, sand, etc. As a result, change the coastline.



RIVERBANK EROSION: The powerful tidal surge from the cyclone hit the riverbank, destroying mangrove forests and eroding riverbanks(Fig-3), causing floodwaters to enter the locality.



Fig-3: River Bank Erosion

Due to the recent cyclone, the riverbanks collapsed and 24.996 acres of land in Budhakhali village of Namkhana block, 21.871 acres of land in Rajnagar village and 34.993 acres of land in Nadabhanga went under the river in six years (**Table-2**).

Table-2: Decline of Land

CYCLONES	BUDHAKHALI Land/acres	RAJNAGAR SRINATHGRAM Land/acres	NADABHANGA Land/acres
FANI	4.374	3.749	8.123
BULBUL	1.875	2.50	3.749
AMPHAN	6.874	4.999	10.623
YAAS	11.873	10.623	12.498
TOTAL	24.996	21.871	34.993

4.2. SOCIAL IMPACT

AGRICULTURAL IMPACT: Cyclones bring strong winds that uproot, distort, or topple crops and break the grain of mature trees. Due to the recent floods, the dam of the Muriganga River has broken and flood water has entered Budhakhali, Rajnagar and several other villages in Namkhana block. As a result, farmers cannot plant Aman rice in these areas in 2021. The salinity of the land in Budhakhali village is 50% and in Rajnagar village 40%, which has reduced its fertility. Currently, crop production in these areas has decreased manifold. As

food shortages arose, people in these areas began to work as migrant workers. The different types of occupations of the study area are as (Table-3).

Table-3: Field survey reports on Occupation

Occupation	Village Name			Occupation (%)		
	BUDHAKHALI	RAJNAGAR SRINATHGRAM	NADABHANGA	BUDHAKHALI	RAJNAGAR SRINATHGRAM	NADABHANGA
Farming	18	12	21	45	30	52.5
Fishing	13	18	10	32.5	45	25
Migrant Workers	5	8	6	12.5	20	15
Others	4	2	3	10	5	7.5
	Total=40	Total=40	Total=40			

Source: Primary Data

ECONOMIC IMPACT: Cyclones have a long-term impact on economic growth. Due to the impact of the cyclone, 50% of vegetable cultivation land in Nadabhanga village of Namkhana has been destroyed. About 6.25 acres of fishery cultivation land in Budhakhali has been destroyed. Currently, Namkhana block has been facing multiple cyclones, so the local economical base has become weak.

INFRASTRUCTURE IMPACTS: Due to the high winds of the cyclone, power lines, poles and communication towers were broken, resulting in a long-term disruption of communication systems. In Namkhana block, a total of 30 electricity poles were broken in Budhakhali, 38 in Rajnagar and 42 in Nadabhanga due to cyclones like Amphan and Bulbul. Flood water entered Yas and submerged several tube wells, leading to a drinking water crisis. In Namkhana block, 10 km of roads in Budhakhali village, 12 km in Rajnagar and 8 km in Fatikpur were destroyed due to the cyclone.

DISPLACEMENT OF PEOPLE: Due to the impact of the cyclone, several river embankments in Namkhana block broke and numerous mud houses collapsed due to the force of the storm, forcing people to migrate from one end of the village to the other (Fig-4).



Fig-4: Migration of Peoples

Due to the cyclone in Namkhana block, 150 houses in Budhakhali village, 202 houses in Rajnagar and 225 houses in Nadabhanga collapsed. As a result, people have been relocated. The number of damage house and the numbers of migrated families are shown in **Table-4** and **Table-5**.

Table-4: Damage houses in different Cyclone

Village Name	CYCLONE				Total Damage houses
	FANI (No of Damage house)	BULBUL (No of Damage house)	AMPHAN (No. of Damage houses)	YAAS (No of Damage house)	
BUDHAKHALI	35	16	44	55	150
RAJNAGAR SRINATHGRAM	42	18	70	82	202
NADABHANGA	56	17	76	95	244

Source: Secondary Data (Panchayat)

Table-5: Table of Migrant family after Fani Cyclone

Village Name	No of Migrant Family
BUDHAKHALI	30
RAJNAGAR SRINATHGRAM	42
NADABHANGA	54

Source: Secondary Data (Panchayat)

HEALTH HAZARDS: Several health related problems in the study area is the major concern after the cyclone. During floods, river water enters canals, ponds, and fills fields, resulting in an increase in the number of pests, which causes people in this area to suffer from various skin diseases including malaria, typhoid, dengue fever, and others.

5. PREPAREDNESS AND MEASUREMENT FOR CYCLONE DISASTER

In India, the Natural Disaster Management Authority (NDMA) is in charge of disaster management. Home Ministry started the National Cyclone Risk Mitigation Project (NCRMP) to improve cyclone forecasting, tracking, and warnings in West Bengal as well as the other part of the country. The several measurable parameters may be adopted; such as

HAZARD MAPPING: A map that displays the frequency/probability of occurrences of different intensities or durations of cyclones is known as a hazard map for cyclones. It is impossible to predict cyclones' days in advance however the pattern of occurrence for specific wind speeds can be determined using historical records and pathways. An area's vulnerability to a cyclone, along with any accompanying storm surge and flooding, will be shown on a hazard map. Estimate the cyclone's power and potential damage intensities in the area will be beneficial.

LAND USE PANNING: Settlement in flood plains should be avoided at all cost. Land use and building code enforcement should be governed by policies. Instead of being used for habitation, vulnerable regions should be preserved for parks, grazing areas, or flood diversion.

CYCLONE EARLY WARNING SYSTEM: The Indian Meteorological Department and the Ministry of Earth Sciences introduced the new Impact-Based Cyclone Warning System. This approach takes into account all the crucial factors, including the local population, settlements, usage of the land, and location warning mechanisms.

CYCLONE SHELTERS: Cyclone Areas that are susceptible to recurring cyclones must have shelters. Since cyclone shelter building requires significant funding, it is frequently dependent on assistance from the government or outside contributors. To ensure that people can quickly access the shelters during emergencies, the location of the cyclone shelter should have road connections to major thoroughfares and to the nearby rural areas.

MANGROVE PLANTATION: The community should take part in the mangrove planting project, which might be run by the local government, an NGO, or even the community itself. Mangrove protects the coastal region from cyclone-related storm surges and wind. The water's flow is slowed down by the branch tangle.

PUBLIC AWARENESS AND COMMUNITY PARTICIPATION: In order to construct community plans, it is necessary to identify vulnerable groups and populations, evaluate the community's hazards, map its resources, and identify specialized teams for swift reaction.

6: CONCLUSION

Most of the people in the study area as well as in sundarbans are engaged in agriculture or fisheries, which are the ways of earning money. Since this area is located near the Bay of Bengal, it is prone to storms. Cyclones are natural disasters that disrupt the atmosphere and cause violent storms and severe weather. As a result, there is a detrimental impact on the agricultural land, fisheries, houses, roads, communication systems, etc. If the government

takes steps to build concrete embankments in Namkhana block, pave all roads and stop soil excavation and tree cutting in the riverside areas, then it is hoped that this area will get some relief from the harmful effects of the terrible cyclones. Lastly it may be concluded that only Government and their policies cannot resolved that problem until the awareness among the peoples aries. The cyclonic disasters cannot be stop but can be reduced the devastating effect.

7. REFERENCE

Hazra.S, Ghosh.T, Das Gupta.R, and Sen.G: Sea Level and associated changes in the Sundarbans; Science and Cultur, Vol 68, no 9-12, 2002.

Adhikary Ujjal (10th July, 2022): Cyclone Disaster and Its Impacts on Rural (Sundarban) Livelihood: A case study on Rural Community of Pakhiralay Village at Gosaba Block, South 24 Parganas, West Bengal.

Chakraborty Bipul (August-2023): Physical and Socio-Economic impact of Cyclone on Sundarban Mangrove Forest under South 24 Parganas, West Bengal.

Rizwana.S, Mokbul.M ; Socio-Economic Impacts of Cyclone Aila on Migrant and Non-Migrant Households in the Southwestern Coastal Areas of Bangladesh, Geosciences **2019**, 9, 482.

Ghosh. R, Bose. U, Bramhachari. S, Living on The Edge;Climate Change and Uncertainty in The Indian Sundarbans, Economics and Social Research Council (ESRC) 2018.

Kar. S, Bandyopadhyay N.K., Tropical Storm Aila in Gosaba Block of Indian Sundarban: Remote Sensing Based Assessment of Impact and Recovery, Geographical Review of India 2015, 77(1), 40-54.

Krauss. S, Osland. K.W., Biswas S., Mandal A., Bhattacharya S., Socio-demographic backwardness in cyclone prone coastal villages: An Insight from Indian Sundarban, Safety in Extreme Environment, Springer 2022, Vol 4, 13-33.

Hoque. C., Phinn M.A.A., Rolefsema S., A Systematic Review of Tropical Cyclone Disaster Management Research Using Remote Sensing and Spatial Analysis, Ocean and Coastal Management, Elsevier 146 (2017), 109-120.