

## Impact of Amphan Cyclone on Sundarbans and Use of Indigenous Geographical Knowledge for Sustainable Management

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### Abstract

Cyclones are almost regular incidents due to prolonged fetch of Bay-of-Bengal and the character is destructive. Years after year people of Sundarbans are facing the cyclone and it is one of the significant reasons for their poverty. Owing to presence of mangroves, the entire coastal area remain safe from major destructions. So, the importance of Mangroves is going to be realized by the people of Sundarbans day by day. Indigenous Education helps the people to take appropriate measures like prediction of cyclones, sustain with the cyclone and to make quick recovery from the cyclones. Geographical knowledge provides them actual scientific reason hidden behind their Indigenous Knowledge. On the basis of these criteria people recover the destruction of cyclone. Sustainable management procedures like development of health and education, construction of flood shelters, constructions of Bridges, enhanced activities of NGOs etc. can be the remedy to face the challenges of cyclone accordingly.

**KEYWORDS:** Cyclones, Sustainable Management, Indigenous Geographical Knowledge, Fetch.

### Introduction

Cyclones are almost regular incidents in Sundarbans. Owing to prolonged fetch through Bay-Of-Bengal, the character of cyclones prevailed over the Sundarbans forest becomes destructive. Geographical significance of this region explains the cyclonic impact on scenic beauties and socio-economic pattern of region. Being the largest mangrove of the world, it is going to be one of the most important tourism centres due to its undulating terrain, salty soil, close impact of tides and a variety of mangroves and animals. The demographic behaviour is also very unique and uniform because of indigenous education achieved from their superiors. There is a strong impact of cyclones on forestry-based occupations of the people and it influenced them to be with struggling mentalities. They become superstitious because adaptation with the forest is very critical question to the people of Sundarbans. The people of Sundarbans do not able to enjoy the charming sceneries but they are usually forced to fight against the dangerous conditions of the forest.

## Objectives

- To study the location area carefully
- To study the nature of forest
- To study the nature of cyclones
- To study the people and their behaviour
- To study the Impact of cyclone on people
- To study the impact of Indigenous Geographical Knowledge on people to protect themselves from cyclones like Amphan.
- To study the impact of indigenous education on people to protect themselves from cyclones like Amphan.
- To suggest the ways for sustainable management

## Methodology:

The study is mainly based on primary and secondary data, practical knowledge and awareness of the cyclone related problems. The photos are basically prepared and edited through Adobe Photoshop software. Web information had been taken a vital role to enhance the quality of the study. Different Geography books, Sundarbans related articles and Govt. data bases are studied to get the geography-based knowledge.

## Location of the Study area:

Sundarbans forest is located on the lower end of the Gangetic deltaic plain belongs to the state of West Bengal (Fig. 1), 22<sup>00'</sup> N — 89<sup>00'</sup> E, at an altitude 0-10 m above sea level and just south of Kolkata (Mukherjee,2008). Since 1989, due to its unique ecosystem with its vast saline mud flats, the Sundarbans has also been declared as a World Heritage site. Other than Nilgiri Biosphere Reserve, Sundarbans Biosphere Reserve has also been included as the second Biosphere Reserve from India (Fig.2), in November 2001 (Das,2014). This Bengal Delta, consists of 10,200 sq km of total Mangrove Forest, spread over India (4264sq km) and Bangladesh (6000 sq km approximately of Reserved Forest) and it is also considered as the largest Mangrove Forest of the world (Singh, 2003). Another 5400 sq km of non-forest, inhabited region in India, laterally the north and north-western peripheral of mangrove forest, is referred to as Sundarbans region in India. Hence, entire area of Sundarbans region in India is 9600 sq km, of which 70% of the area lies under saline water belongs to the Sundarbans Biosphere Reserve. Sundarbans, which is also the world's largest estuarine forest, is a land of 54 tiny islands (Neogi,1987), crisscrossed by innumerable tributaries of the Ganga river. Rabindranath Tagore, when visited Sundarbans, stayed at Gosaba in 1932 to enjoy the amazing beauties of mangroves. The education system of this region is regularly disturbed by several hazards. Sundarbans is an extended tract of forest in which saltwater swamp forming the lower part of the Ganga Delta, spreading about 260 km length ways the Bay of Bengal from the Hooghly River inlet (India) to the Meghna River in let in Bangladesh. Indian Sundarban is basically bounded by river Muriganga in the west and by river Harinbhanga and Raimangal in the east (Fig-1).

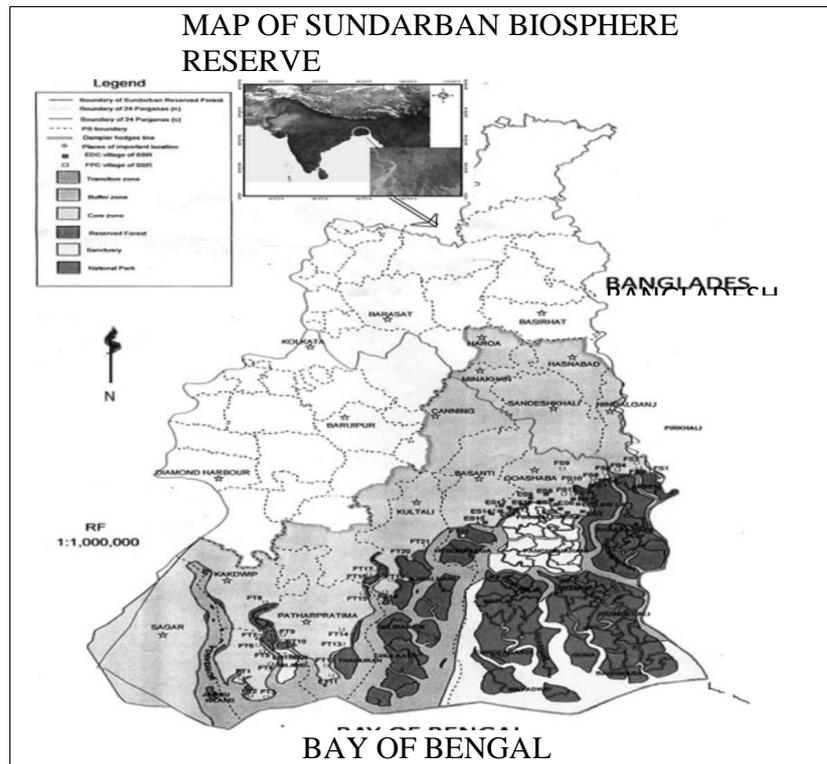


Fig.-1: Sundarbans Biosphere Reserve (After GIS, 2019)

**Demographic Factors:**

People in Sundarbans live in an ecologically acute vulnerable environment. The area is usually cyclone prone. Low-lying areas with many human settlements located along the waterways and coastline. Around 4.4 million people (Table-I) live in Indian Sundarbans (3.5 million in Bangladesh), amongst which 32% is depended on the resources of Sundarban mangrove forest directly / indirectly. On which almost 33, 05,300 people live in Sundarbans resided at South 24 parganas (Table-2). Here dense population is found in Basanti, Canning-I &II, and also Pathar pratima Blocks considers as Sundarbans. Forty-four percentage of the total population belongs to schedule caste and tribe, of which 65% are living on the agriculture-based economy and 50% are landless agricultural labourers, marginal farmers etc. Almost 12% people are existing to the Santhal tribal group (Sarkar K, 2012).

Table-I: Total Demographic Pattern of Sundarbans (South and North 24 Parganas)

Year	1951	1961	1971	1981	1991	2001	2011
Total Population	1159559	1532102	2003097	2455365	3205528	3757756	4422033

Source: Data obtained from O/C, Census, South 24-Parganas

Table-2: Demography of Sundarbans, South 24 Parganas

SL. No.	Block/ Municipality	Population 2011(Provisional Population Total)			
		Persons	Males	Females	Others
1	<b>Basanti</b>	<b>336151</b>	<b>171549</b>	<b>164597</b>	<b>5</b>
2	<b>Canning - I</b>	<b>304704</b>	<b>155389</b>	<b>149304</b>	<b>11</b>

3	<b>Canning - II</b>	<b>252622</b>	<b>128926</b>	<b>123695</b>	<b>1</b>
4	<b>Gosaba</b>	<b>246682</b>	<b>126204</b>	<b>120478</b>	<b>0</b>
5	<b>Jaynagar - I</b>	<b>262336</b>	<b>135156</b>	<b>127176</b>	<b>4</b>
6	<b>Jaynagar - II</b>	<b>251206</b>	<b>129082</b>	<b>122122</b>	<b>2</b>
7	<b>Kakdwip</b>	<b>281502</b>	<b>144272</b>	<b>137226</b>	<b>4</b>
8	<b>Kultali</b>	<b>228988</b>	<b>117775</b>	<b>111213</b>	<b>0</b>
9	<b>Mathurapur - I</b>	<b>194715</b>	<b>100072</b>	<b>94638</b>	<b>5</b>
10	<b>Mathurapur - II</b>	<b>220068</b>	<b>113790</b>	<b>106277</b>	<b>1</b>
11	<b>Namkhana</b>	<b>182728</b>	<b>93506</b>	<b>89221</b>	<b>1</b>
12	<b>Patharpratima</b>	<b>331605</b>	<b>170081</b>	<b>161521</b>	<b>3</b>
13	<b>Sagar</b>	<b>211993</b>	<b>109827</b>	<b>102165</b>	<b>1</b>
	<b>Total</b>	<b>3305300</b>	<b>1695629</b>	<b>1609633</b>	<b>38</b>

Source: Data base on O/C, Census, South 24-Parganas

Within the minorities people Muslims are large in number. Almost 27.90 % ,out of 28.595 total minorities people, are coming from Muslim Community. Out of 218667 households, 50.74% are under BPL (Below Poverty Level) (Table-3) which is highly indicating the poverty scenario of the people. Owing to this reason people of this region are unable to take proper protection from natural the calamities.

Table-3: Minorities Populations of Sundarbans, South 24 Parganas

Type	Total Persons	Muslim Persons	% of Muslim	Other Minorities	% of Other Minorities	Total Minorities	% of Total Minorities
Minorities Population	2795154	779923	27.90	19131	0.69	799054	28.59

Source: Data obtained from O/C, Census, South 24-Pargana

Table-4: BPL Populations of Sundarbans, South 24 Parganas

Type	Total Households	BPL Households	% of Households	BPL Households (SC)	BPL Households (ST)	BPL Households (Minority)	Total Households (Others)
Sundarbans	669669	339819	50.74	53894	14728	52530	218667
District Total	1488874	655164	44.00	105863	18353	150481	380467

Source: Rural Household Survey, 2005(after disposal of Claims and Objections in 2009).

### Education:

In Canning Subdivision, literate people are high in Gosaba block while literacy rate is not enough in Canning II Block (Mistry, D. 2015) belongs to Sundarbans area. Literacy rate is going to be increased day by day in the whole Canning Subdivision as

well as Sundarbans today. In this sub-division during 2001, total literacy rate was 59.90 percent and in 2011, total literacy rate is being increased up to 70.98 percent. Within the year 2001 to 2011, Male literacy rate has been significantly increased by almost 7%. Female literacy rate during this period has also been increased by about 16%. So, it is very remarkable fact that the female literacy rate is going to be increased rapidly in the study rather than male literacy rate. From the year 2001 to 2011, total literacy rate of Canning II Block has been increased more than other Community Development blocks under this area (Mistry, 2015).

### Occupations and Economic Structure:

The district South 24 Parganas ranked 10th during the financial year 1993-94 and in 2009, it is ranking 12<sup>th</sup> on the basis of per capita income (DHDR, 24 Parganas, 2009). That proves that the per capita income of this district is going to be decreased rapidly. The share of the primary sector in net domestic product is going to be declined both in the state of West Bengal as well as in the district of South 24 Parganas too between financial years 1993-94 and 2003-04. It had been noticed that particularly the district is achieving the healthy rate of growth of output in the secondary sector. According to the report has been published by BAE&S on the state and district domestic products of West Bengal, the output of secondary sector at constant prices had been doubled between the secession 1993-94 and 2003-04, with the growth that has been evenly spread among the construction, manufacturing, electricity, gas and water supply. The annual average compound growth rate in the secondary sector was 7.18% over this period (Table-6). The population pressure on land is going to be historically very high in West Bengal and the district of South 24 Parganas have of no exception.

Table-5: Annual Average Compound Growth Rate of Net Domestic Product between 1993-1994 at Constant Price

District	Annual average compound growth rate of net domestic product		
	Primary (%)	Secondary (%)	Tertiary (%)
S-24 Parganas	3.79	7.18	8.98
West Bengal	3.64	5.95	9.91

Source: BAE&S, GoWB

Table-6: Land and Agricultural Workforce Relationship in different Blocks of South 24 Parganas under Sundarbans

Block	Net Area under Cultivation (in hector)	Rural Population	Total Agricultural Workers	Relative ability of cultivable land (ha per capita)	Cultivable land per agricultural workers	Agricultural worker as % of total workers
Canning-I	15,826	183131	29,359	0.07	0.54	37.13
Canning-II	15,748	244627	43,863	0.08	0.36	73.93
Basanti	26,151	195967	66,004	0.09	0.40	74.02

Gosaba	17,000	278592	63,277	0.08	0.27	73.53
Joynagar-I	9,402	222822	22,209	0.04	0.42	33.78
Joynagar-II	15,553	214026	36,698	0.07	0.42	54.08
Mathurapur-I	11,980	209145	21,303	0.07	0.63	46.73
Mathurapur-II	17,878	164650	40,558	0.09	0.44	62.54
Kultali	19,923	189281	42,135	0.11	0.47	71.61
Patharprotima	36,429	187989	80,887	0.13	0.45	65.84
Kakdwip	15,973	288394	44,487	0.07	0.36	53.26
Namkhana	16,910	160627	43,895	0.11	0.39	63.81
Sagar	17,436	185644	55,683	0.09	0.31	73.93

Source: BAE&S, Go. w.B., Census of India, 2001

#### **Effects of Amphan on Sundarbans:**

Amphan changed into a completely effective Super Cyclonic Storm and adverse tropical cyclone that precipitated in Sundarbans, in May 2020. It became one of the strongest tropical cyclones to strike the Gangetic Delta like 'Sidr' of the 2007 and other wonderful cyclones that stroked West Bengal considering the fact that 1582, after 1737 and 1833. Amphan is likewise the devastating cyclone ever recorded inside the Northern part of Indian Ocean, surpassing the data in different cyclones.

Being the first tropical cyclone of the year 2020, North Indian Ocean cyclonic season, Amphan turned into originated from a low-pressure zone persisting more than triple hundred kilometres (three hundred km) east of Colombo, the capital of Sri Lanka, on thirteen May 2020. On 17 May, Amphan intensified and became an extremely very excessive cyclonic storm within very few hours.

On 18 May, Amphan achieved its peak intensity with triumphing wind speeds of 240 km/h

(150 mph) sustained for three-minute, wind speeds of 260 km/h (160 mph 1-minute) sustained for 1 minute with a minimal 920 mbar (27.17 in Hg) critical barometric strain. After reaching its top intensity the hurricane began an eye wall alternative cycle shortly. The whole method become disrupted through the non-stop outcomes of dry air and wind shear and ultimately caused Amphan to gradually weaken as it has become parallel the eastern coastline of India. On 20 May, the cyclone made landfall between 10:00 and eleven: 00 UTC at Sundarbans, West Bengal. At the time, in step with JTWC, the anticipated wind pace of Amphan was one hundred fifty-five km/h (100 mph) which sustained for one minute. Gradually after coming into the coastal land of West Bengal in addition to Sundarbans, Amphan unexpectedly weakened and dissipated rapidly thereafter. Chief natural world warden Ravi Kant Sinha said that as in step with their initial estimate, approximately 1, six hundred square km location within the Sunderbans vicinity had suffered big damages. The damage comes when the Forest Survey of India (FSI) has pegged a loss of extra than 2% mangrove cover inside the Sundarbans region in between 2017 and 2019. The mangroves generally act as an herbal protect for Kolkata in addition to Bengal Delta from the impact of each cyclones like Amphan.

The storm Amphan has triggered siltation and spread out the river creeks that would have lengthy-term influences at the mangroves. In the Vidya and Haldibari areas,

some tidal creeks had been spread out by using the excessive cyclone. Impact of tidal sample goes to be changed due to trigger erosion of islands because it has been delivered in the navigation course maps too. State natural world advisory board member Biswajit Roy Chowdhury said aside from erosion, starting up of creeks might cause overflow of saline water into villages. Owing to presence of forest village dwellers have probably suffered greater damages in evaluation to the forested islanders. According to him, top of inundation level became lower and happened over shorter duration inside the forested islands.

Though no longer a great deal instances of animal casualty has been mentioned from the Sundarbans, the lack of vegetables, mud made houses, bushes, roads, electric poles and river side's land sliding took the essential role in this regard (Mukherjee, 2020).

Table:7 Super Cyclone Amphan: Damage Report Extract

SL No.	Sector	Extent for Assessed Damage so far	Quantum of Damages (INR Crores)
1	Dwelling Houses	28.56 lakhs damaged	28,560
2	Agriculture	171akh hectors agriculture land crops-Boro paddy, Moong, Till/Jute/Groundnut/ Sugarcane/ Maize /cotton	Not available
3	Horticulture	Area-2,50,556.17 Ha Betel vine, Litchi, Mango etc	6,581
4	Fisheries	Boats-8007, Huts-1.481akhs	2,000
5	ARD	Animals lost-21.221akhs	452
6	Drinking water	Piped water scheme affected 1192	2,060
7	Roads including rural roads and culverts/bridges	Roads-2, 148.22Km, Bridges & Culverts-355, Rural Road-10,091.17	2,237
8	Irrigation canals/Ponds	Enbankments-244.73 Kms, Sea Dykes-3.6Km	2,944
9	Power	Power Sub Station damaged:273poles-4,49,174	3,230
10	Forest	Forest area affected 1.58 hectors	1,033
11	Education Infrastructure	14,640 schools, 301 colleges	793
12	Health Infrastructure	PHC-563, BPHC/RH-169, Sub Centre-5,142, SDWSGH-37, DH-24	1,270
13	Anganwadi infrastructures	ICDS Centres damaged 12,678	342
14	Urban Infrastructure	Municipal Roads, Street Lighting, Underground Sewerage System, Strom, Water drainage, Water supply scheme, Roads etc.	6,750
15	Industries including MSME	Industrial ware house/ raw material/ Industrial Infrastructures/ Sheds	26,790

16	Miscellaneous	Transport, Fire & emergency Infrastructure, Godowns, Housing, correctional Homes, BCWs	1,540
		Total Losses	1.02,442

Source: Dey, 2020

### Problems:

There are so many problems created during cyclone may be enlisted briefly as follows:

- 1) A lot trees had been broken
- 2) A lot of people dead
- 3) A lot of electric posts were broken.
- 4) So many domestic animals died
- 5) Many mud houses were broken.
- 6) A vast agricultural land submerged under saline water.
- 7) Many natural and artificial river side levee were broken.

After few days of cyclone other side effect came

- 1) Health problems of people created
- 2) Educational institutions were hampered.
- 3) Economic problems created
- 4) Transportation damaged
- 5) Internet facilities hampered.
- 6) Food Supply hampered

### Sustainable Management:

- 1) To control the uprooted trees, plantation is the only substitute. To protect mangrove plantation of trees based on mangrove species is highly acceptable remedy. Other than these some trees having thick trunk like Mango, Banyan etc can be planted simultaneously with mangroves. Jatrofa trees may be the substitute tree for economic development of the dweller because of its efficiency to create bio-diesel.
- 2) Death of people may be controlled with the help of Flood centres. Large flood centres can be the temporary shelter for the vulnerable people.

- 3) To get remedy from electricity problems due to broken lamp posts, underlined electricity line may be the proper and suitable alternatives.
- 4) To save the domestic animals, people can tie up their animals with the pillars of the flood centres in the ground floor. For proper health check up, some veterinary hospitals must be established. For birds, bird shelters can be made in near the roof of the flood shelters.

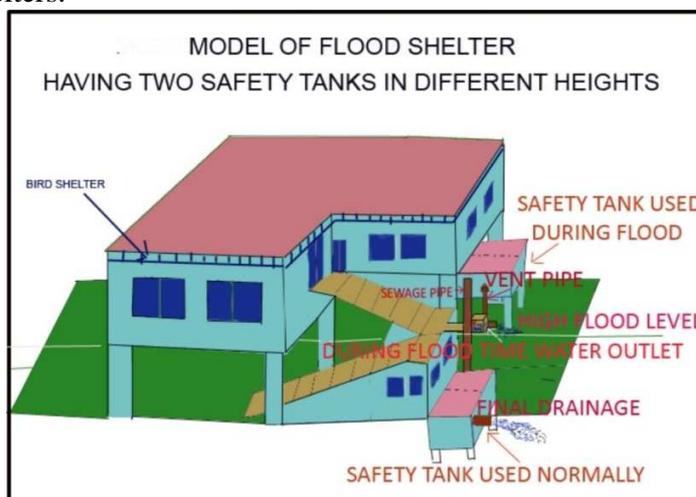


Fig: 2 Model of flood Shelter

- 5) Mud houses are mainly broken due to heavy rain. Cyclone swift out the roofs of the houses and then the buildings are broken having no protection. Proper implementation of Indira Abas Yoyona can be the alternative to provide them Pucca (concretized) buildings.
- 6) To get protection of crops from the submerged saline water people has to use such vegetables and crops which can resist in saline water. Amongst the rice species Hamilton (since the species was used first by Hamilton).
- 7) Due to high tidal influence, a lot of natural levee and embankments have been broken. It can only be protected, if the embankments are concretized. Trees must be planted in the embankments.
- 8) To rescue from the health problems of the Sundarbans people, more hospitals must be established. There is only one hospital in Gosaba near to the hinge area of Sundarbans. Others are primary health centres not much efficient to take care of the vulnerable people. Mobile hospital concept may be introduced there for providing quick service too.
- 9) To rescue the affected people, transportation systems should be improved. Some bridges on the river Netai, Vidyadhari, Matla, Gomor etc. can interconnect the delta and the people of Sundarbans. Proper communication will help the relief team to send medicines, food and other valuable accessories a lot. It will also help to reconstruct the transportation and communication system also.
- 10) After getting warning from the meteorological stations, sufficient dry foods and medicines should be stored in the flood shelters, Schools etc to provide quick service for the people. Above all, indigenous geographical knowledge can develop some essential concepts for the people of Sundarbans as follows

- i) They usually took shelter in the opposite side of the direction of cyclone prevails
- ii) They can predict the cyclones after looking at the wind directions. They use dust and throw it gently to understand the wind directions as well with the help of indigenous education.
- iii) They construct the house buildings well with the help of indigenous education in such a way and such a direction, which remain safe during cyclones.
- iv) They stayed their boats and tied up in such a way which is remarkable and use of proper indigenous knowledge.
- v) They can predict the cyclones by following the uneven behaviours of the insects and animals of the forest too base on their indigenous education.

### **Conclusion:**

Sundarbans is a land of tigers, land of cyclones, land of mangroves but it has its own identity for the communal harmony. This land is happy for their active life. They take risks and believe in their superstitious power. They can enjoy safe and better life, if proper implementation of aforesaid management system can be done. Govt. is taking many steps, so that the progress of the region can enhance the livelihood of the Sundarbans dwellers but at the same time different descriptive and fundamental research is also required. Different projects are essential for the development of the people economically in the region, where till today people are highly dependent on indigenous primitive education.

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