Chapter Seven

NATURAL HAZARDS IN THE HISTORY OF SUNDARBANS: ADAPTATION AND MANAGEMENT

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7 NATURAL HAZARDS IN THE HISTORY OF SUNDARBANS: ADAPTATION AND MANAGEMENT

7.1 Introduction

The Sundarbans are a part of the world’s largest delta formed by the rivers Ganges, Bramhaputra & Meghna. Among the calamities that overtake the region are great inundations caused by cyclones or hurricanes.¹ In fact the monsoon in this part of Bengal consists of a series of severe cyclonic storm or depression, which follow each other in more or less close succession up the Bay of Bengal.² In other words, the area experiences the most severe storm surges in the world. O’ Malley while composing his Gazetteer of 24 Parganas (1914) noted that there is “no safeguarding against the sudden fury of a cyclone and the even more destructive storm-wave which sometimes accompanies it. To such cyclones the districts is peculiarly exposed on account of its position at the head pf the Bay of Bengal, and its record show that though they occur at irregular intervals these violent storms are far more destructive of life property than either droughts or floods”.³
7.2 Tropical Cyclones and the Sundarbans

A tropical cyclone is a storm system typically characterized by a large low-pressure center and numerous thunderstorms that produce strong winds and heavy rain. It usually strengthens when water, evaporated form ocean, is released as the saturated air rises, resulting in condensation of water-vapour contained in the moist air. Depending on its location and strength, a tropical cyclone is referred to by names such as hurricane, typhoon, tropical storm, cyclonic storm, tropical depression and simply cyclone. While tropical cyclones can produce extremely powerful winds and torrential rain, they are also able to produce high wave and damaging storm-surge as well as spawning tornadoes. They develop over large bodies of warm water, and lose their strength if they move over land due to increased surface friction and loss of the warm ocean as an energy source. This is precisely why coastal regions can receive significant damage from a tropical cyclone, while inland regions are relatively safe from receiving strong winds. Heavy rains, however, can produce significant flooding inland and storm surges can produce extensive coastal flooding up to 40km/25miles from the coastline. Besides, their effects on human population can be devastating.4
In the Sundarban area, tropical cyclones with variable wind speed of 63 km/hr – 87 km/hr are regular phenomena. Each period of general heavy rainfall is, in fact, initiated by the advance of a cyclonic storm, which gives concentrated rainfall over long narrowish belts of the country. In popular parlance, however, the term ‘cyclone’ is reserved for the most violent storms which burst more especially in the transition periods, i.e. in May, before the monsoon is fully established and in October when it has not altogether disappeared. The conditions are, on the whole, favourable for the formation of the most severe cyclones in October, when the humid currents that provide the motive power are still of moderate strength. These October cyclones in the Sundarbans, are examples of the most
intense tropical storms. They are usually of small extent, occasionally not exceeding 200 miles in diameter. Thus the shifts of wind accompanying them are very rapid and dangerous to vessels, and October is the most critical period of navigation in the Bay of Bengal. The pressure gradients are very steep and the winds are of hurricane intensity in the inner storm area. The precipitation is excessive, the rain being commonly described as ‘falling in torrents’. The most characteristic feature in the worst storms is an inner central area of calms or light variable winds, occasionally 10-20 or even 30 miles in diameter, which is termed by sailors as ‘the eye of the storm’. The transition from the clam area to the belt of hurricane winds is usually exceedingly rapid. 7

Cyclonic disturbances are familiar phenomena at the head of the Bay of Bengal, but the havoc caused by them do not usually reach catastrophic proportions unless they are simultaneous with ‘tidal waves’. 8 Indeed another characteristic feature of these cyclones is the pilling up of a mass of water in the inner storm area and area of lowest pressure. This advances with the storm and strikes the coast as a ‘storm wave’. 9 According to one author these great tidal
waves take its origin in the ‘Southern Ocean’, rushes with impetuosity up the Bay of Bengal, breaking in an angry surf all along the Coromondal coast, and at times cutting off all communication between the shipping and the shore. This wave when aided by the South West Monsoon and by the full or change of the moon, rushes with great force up the rivers of the Delta, where it is opposed by the freshes that descend from the up-country during the prevalence of South West Monsoon. It is this which the sailors call as the much dreaded ‘tidal bore or wave’.

The effect of this in flooding the coastal districts depends largely upon the phase of the ordinary tidal wave at the time when the storm wave strikes the coast. If the wave strikes the coast about high water or shortly after, it may produce the most disastrous results, flooding low coast districts in a few minutes to a depth of 10, 20, or even 30 feet above tidal high water level. Cyclones of the most dangerous type are fortunately rare, not more than one, on the average, occurring in five years.
7.3 **Destructions caused by Cyclones**

The gazetteers are full of descriptions of the damage caused by the cyclones. In the low-lying Jessore Sundarbans the houses of the inhabitants and their fields are only a foot or two above high water mark and when the cyclone wave pours up the great streams of the Pasar and the Haringhata and from them spreads all over the country, the inundation works cruel havoc among these low-lying isolated villages. The grain in their field are spoilt, their houses are torn away, and all their stores are lost, their cattle are carried away and drowned and they themselves are reduced to the extremest shifts to save their own lives. The chief danger to which the cultivators are exposed is excessive precipitation resulting in prolonged inundations and the consequent destruction of the paddy seedlings.\textsuperscript{12}

Thus instances of the widespread havoc and terrible inundations caused by such tornadoes and very frequent in the coastal regions. A commonly held view is that the devastating action caused by the cyclones and the irresistible storm-waves might have compelled the inhabitants to quit the Sundarbans for a safer region northwards.\textsuperscript{13} One author goes as far as to state that the
“Soonderbuns in their present state can never be inhabited, they are too exposed to the fury of the Tropical Hurricane that arise in the Bay of Bengal.” We are, in fact, told of an immense storm-wave, caused by the influence of typhoons and cyclones, which suddenly raised the waters of the sea, and dashed them over a fourth of the province of Bengal, sweeping away in its course all traces of habitation and thus accounting for the existence of the forest, which however, there is ample evidence to show was of gradual growth and extension. One must note that this conjecture of a partial deluge is unsupported by tradition. One is therefore clearly amazed by the destructive force of the Sundarban cyclones, especially known for the strength and power.
7.4 Severe Cyclonic Storms in the History of Colonial Sundarbans

The earliest cyclone of which there is an historic account appears to have been that of 1582 AD, which swept over Sarkar Bakla i.e. Bakergunje, causing the loss of 200,000 lives and the destruction appears to have been caused mainly by a storm wave. For five hours the hurricane and thunderstorm destroyed houses and boats and only some Hindu temples having a strong foundation were spared. In 1585 another tropical storm hit the eastern side of Bakergunj near the mouth of the Meghna river estuary, causing huge devastation to crops. In 1699 a severe cyclonic storm crossed the Sundarban coast and killed 50,000 people. The cyclone of 1737 devastated Calcutta. Sir Francis Russell wrote that “the whole place looked like a place that had been bombarded by an enemy. Such a havoc did it make that it is impossible to find words to express it”. Again in 1767 a cyclone with a surge height of 13.03 m/43 ft crossed the Bakergunje coast, killing around 30,000 lives.

The 19th c witnessed many severe cyclonic storms in the Sundarbans region, which resulted in huge damages to
life and property. In June 1822 a severe cyclonic storm with a coast of hurricane winds crossed the coast of Bakergunj at Sarkar Bakla, killing 50,000 people along with about 100,000 cattle. The storm wave is known to have swept away the collectorate records.\textsuperscript{19} On 31\textsuperscript{st} October 1831, another severe cyclonic storm crossed the Barisal coast and was accompanied by a surge height of 2.12-4.55 m (7-15ft). The storm killed 22,000 people and 50,000 cattle.\textsuperscript{20} In May 1833 a powerful cyclone hit Sundarban coast. The Saugor Island was submerged in 10 feet water and the whole population, between 3000-4000 souls, together with some of the European superintendents perished. On this occasion an East Indiaman, Duke of York, was carried into the rice fields at Falta, and left there high and dry. Already in June 1823 a storm had destroyed the roads, embankments and crops on the island.\textsuperscript{21}

O’ Malley in his Gazetteer on 24 Parganas, noted that “the most disastrous cyclone within living memory is that of 1864”. The destruction caused by the cyclone was two fold. First, the violence of the wind caused widespread destruction to houses and trees. Secondly, the storm wave brought up by the gale swept over
the country to a distance of 8 miles inland on either side of the Hooghly as far north as Achipur. This wave rose in some places to a height of 30 feet sweeping over the strongest embankments, flooding the crops with salt-water and carrying away entire villages. At Saugor Island it was 15 ft above land level and appeared to cut a channel straight across the island, dividing it into two halves. The embankments, houses, huts, golas and buildings were destroyed and out of a population of nearly 6000, less 1,500 survived. Those that did escape were saved by climbing up trees or floating on the roofs of their houses, which the waves swept away and carried many miles inland. The distress and suffering to which the survivors in the affected tracts were exposed after the disaster were very great. For several days food was not obtainable, for the local stores had been swept away, relief could not be sent from Calcutta. In some places which escaped the storm-wave, the stores of the rice merchants were broken open and plundered. In others a kind of grass was eaten as food. The cyclone also wrought immense havoc among the shipping in the river.22

Again on 1st November 1867 (a part of 24 Parganas) was hit by a storm traversing the country nearly due east from Calcutta.
to Basirhat on the Ichamati river. In this line, villages were blown down wholesale and their destruction was accompanied by loss of human life, the more populous places suffering severely. The effect of the hurricane was most disastrous in Port Canning, where the gale was accompanied by a storm wave, the water of which passed over the town with fearful violence. The station house, goods-shed and railway hotel - were all blown down the Port Canning Company’s store hulk carried away a large portion of the railway jetty. The storm wave, beginning from Saugor Island, extended to the extreme east of the district, and in some rivers the water rose to six feet about flood level. Another disastrous cyclone appeared in 1870 which destroyed a large area where the water raised up to 10 feet. The submersion of land was so heavy that in a rough estimate during 1882, it was found that the exposed land area in Sundarbans which was not under water was only 786 sq miles.

Between 29 October - 7 November 1876 Sundarban region was hit by a very severe cyclonic storm known popularly as the famous/ great Bakergunje Cyclone of 1876. It was an extremely severe cyclonic storm with a core of hurricane winds. It crossed the coast of Bakergunje near Meghna estuary and was accompanied by a surge
height of 3-13.6m/10-45 ft.\textsuperscript{25} An account of this famous cyclone has been left by Sir John Elliot. At that time over 400,000 people were drowned in the floods by the simultaneous action of the tidal wave and the storm wave in the districts of Bakergunje, Noakhali, Chittagong. The flood water is said to have reached 45 ft of Meghna and was about 10-20 feet on the average in the total area inundated. The total area affected by the cyclonic storm extended over 3000 sq miles.\textsuperscript{26} On 16\textsuperscript{th} May 1869 the another cyclone destroyed 250 lives in Morrelgunge alone and caused an immense loss to property.\textsuperscript{27}

The Bakergunje area witnessed another terrible cyclonic storm on 25\textsuperscript{th} May 1941, sweeping over the islands at the mouth of Meghna and the adjoining districts of Barisal and Noakhali. It caused widespread destruction of life property. The loss of life has been estimated at five thousand to ten thousand and destruction of property at amounts running to crores. The economic life in the stricken regions had been ruined, and it could take full one generation to recover from its effects.\textsuperscript{28} These cyclones proved again and again the immense power of mother nature and the utter helplessness of humans in its face. It also exposed the inadequacies
of protective measures against such natural calamities as well as the need to urgently focus on this aspect more seriously.

### 7.5 Earthquakes and Floods

An article in Calcutta Review (1859) pointed out that “The catalogue of earthquakes that have shaken the Delta is a long one, though only extending over a little more than one hundred years”. Captain Baird Smith enumerates, in his ‘Memoir of Indian Earthquakes’, 162 distinct earthquakes between the years 1800-1842 and many of these convulsions were felt in the Delta. He refers to an interesting account of a great storm earthquake that devastated Calcutta in 1737, published in the Gentleman’s Magazine and printed in 1738-39. “In the night between the 11th and 12th October 1737, there happened a furious hurricane at the mouth of the Ganges which reached 60 leagues up the river. There was at the same time a violent earthquake which threw down a great many houses along the river side.”

On 2nd April 1762 another severe earthquake caused considerable rise of sea water and submerged almost whole of Sundarbans for considerable period. Most of the area became non-inhabitable for a few years.

There are records of some minor earthquakes during 1810 and
1829 in Sundarban area. On November 1842, another severe earthquake occurred with epicentre somewhere in 24 Parganas or Jessore. This quake is known to have destroyed several ports of Sundarbans. As evidence of recurring earthquakes one can note down the fact that the surface of Sundarbans has more than once sunk below the level of the ocean and the evidences of subsidence are too palpable to be misunderstood. The severest earthquake “within the memory of the present generation” occurred on 12th June 1897, when many buildings were damaged and others brought down. Another quake was experienced on 14th July 1885 and there were several earth-tremors of less intensity or severity in the previous years of the 18th.

Floods are known to have occurred in 1823, 1838, 1856, 1864, 1868, 1871 on such a scale as to seriously affect the crops of the district 24 Parganas, but not such as to cause general destruction of them. The flood of 1871, which was the result of excessive rainfall, was a serious inundation in the eastern and north eastern portion of the district. In the inundated tracts, a large portion of the aman rice crop was destroyed. When the water finally subsided, a
large number of cattle died partly from want of food, and partly from eating grass which had become rotten from long immersion in water.\textsuperscript{33} Most serious floods (mainly in the district of 24 parganas) have been those of 1900, 1904, 1907. In fact in September 1900 there was abnormal rainfall, the total for the month being 38 inches, which caused floods all over the 24 Parganas and damaged nearly the whole of the standing crops.\textsuperscript{34} These clearly show that floods in the Sundarbans are not uncommon.
7.6 Other Natural Hazards: Problem of Salinity and Subsidence

The problem of salinity and lack of fresh sweet drinking water is a perennial problem of Sundarban delta. Settlers had been forced to change their habitat due to rivers silting up and sudden lack of fresh water, which is a prerequisite for survival. Often the embankments collapsed due to cyclonic storms or lack of its proper maintenance, and saline water invaded the paddy fields. This destroyed the crops and meant a huge loss of property. Besides, certain ecological events also conditioned the flow of sweet water in one region and its lack of flow in another. Here we may cite the 16th c phenomena of the tilting of the Ganges basin to the east, due to some neo-tectonic movements, which had an impact on the history and development of the region through which the river flowed. While the eastern portion now received more fresh water, the land became fertile for rigorous rice cultivation, the economy flourished, towns emerged and there was a general sense of prosperity and well the being
among the people. The district of Bakargunje can be seen in this light. But on the western portion, which stopped receiving sweet water, problem of salinity became a major issue. This had an impact on the economy of the region. Soon the region became stagnant and there was a decline in the general prosperity of the area.35 Thus one can easily understand how salinity of the ecosystem has come to affect the lives of the settlers there. Hunter as well O’ Malley have noted how the village of Gobra on the Kabadak came to be virtually abandoned when the river suddenly changed its course and started to silt up. This stopped the flow of sweet water which was so important for cultivation. Eventually the village was saved by the building of embankments.36 Hence the people adapted themselves to this natural hazard by building embankments, canals or even by enclosing and cutting up ‘khals’ to preserve sweet water.

Beveridge in his history of Bakargunje (1876) opined that the unsettled condition of Sundarbans is solely due to the formation of the sub-marine hollow known as “Swatch of No Ground”. Indeed Sundarbans region has been affected by frequent subsidence in some parts which made it vanishing great
chunks of forest lands as well as busy ports and other settlement areas. In fact, historians believe that the impermanence of early Sundarbans settlement was to some extent affected by the phenomena of subsidence. As a proof of this Gazetteers often refer to remnants of sundri forest found buried near the vicinity of Calcutta. (Hunter). In 1863 Fergusson opined that due to interaction of east and westward current in Sundarbans this 'Swatch of no-ground' has been formed and silts brought from the rivers cannot settle in this place. These silts are either diverted to the south of Sundarbans or are being pushed forward further eastward and new islands are formed. All the river mouths are said to be influenced by this 'Swatch of No Ground'. One thing is certain that along with cyclones, earthquakes and floods, subsidence too changed the physiographic of Sundarbans and played havoc in the lives of settlers.
7.7 **Colonial Disaster Management**

In a region of severe cyclonic disturbances like the Sundarbans, disaster management by the ruling authority becomes a vital aspect of administration. The notion of disaster management can be studied under three heads, namely, pre-disaster management, during the disaster relief measures and post-disaster management. The relief measures undertaken by the colonial administration and their attitude towards such natural disaster is an area much neglected. In order to prevent widespread damages caused by the cyclones and floods, the colonial administration, as pre-disaster efforts, introduced in Sundarbans some safety measures like the construction of high embankments and tower houses around the settlement areas. Some regions of the Sundarbans like the Bakargunj coast, Morrelgunje and Saugor Island are areas most badly affected by the cyclonic storms. One can get a picture of colonial relief measures in Sundarbans by citing the case of Saugor Island. As in 1864, in 1867 there occurred another severe storm high tide which threw the island still further back and caused great damage. The natural calamity forced attention again and again to the necessity of providing means of
safety, especially safety for human life. Interestingly, it was found that the embankments that have been erected had not been a sufficient protection. After much discussion it was at last settled that in each estate in the island, a central place of refuge should be constructed, consisting of a tank surrounded by an embankment $16^{1/2}$ feet high, that no habitation should ordinarily be built more than a mile from the place of refuge and that embanked paths should be made connecting the place of refuge with habitation. Accordingly the place of refuge was constructed and was subject to annual inspection. But since 1867, there occurred no severe cyclonic waves which could test the efficacy of the arrangements. In case of floods, relief sometimes arrived from Calcutta and when that too was affected because of flooding, the local people had to fend for themselves. When there occurred uneven rainfall as in 1904, 1905 and 1907, the result was distress, to cope with which the distribution of agricultural loans and other relief measures were necessary and was provided. But we are told that the natural and artificial means of communication such as roads, railways, rivers and navigable creeks were, however ample to ensure the easy importation of grain to areas where there was a local storage. In fact the people generally were regarded as immune from famine.
As an example of during-the-disaster management one can cite the 1866 famine in the district of 24 Parganas. Since 1770 the only famine from which the district of 24 Parganas had suffered was that of 1866, which, however, did not affect it very seriously. During this time, in May 1866, the Collector was authorized to begin relief works on certain roads in the south of the district if any need for employment would arise. The administration made inquiries and found that many people were living on leaves and roots and the grain which had been reserved for sowing was being used for food. Thus money and rice were freely distributed to the famishing and relief committees were organized in July. Next month it became necessary to import rice into the district. The Commissioner of the Division proceeded on tour of inspection through the affected areas in October and directed the immediate commencement of works at many places as possible, on three or four lines of road running through the distressed tract, and authorized the Magistrate to undertake any other work which he could devise. In the meantime the Public Works Department had supplied employment, for all who wanted it, on the embankments and roads. Number of relief centres throughout the district was set up and they numbered around
nineteen. The mortality from direct starvation was very small. Those affected had succumbed to attacks of diarrhoea and dysentery, due to the high price of food. After the great cyclone of 1876, huge blocks of land were abandoned by the cultivators. These estates were rapidly returning to jungle. In 1904 revenue officers in Bakarganj district identified a block of land consisting of some twenty estates resumed by colonial government in this storm affected region. Four hundred fifty sq km of the total block were considered suitable for settlement and cultivation. A specially appointed colonization officer given wide power and resources, began work and encouraged the Magh or Arrakanese to settle there under the scheme. This was a classic example of post-disaster management, when efforts were made to resettle inhabitants in a region abandoned due to a cyclone.
7.8 Official attitude to Natural Disasters

W. W. Hunter’s ‘A Statistical Account of Sundarbans’ is regarded by many as the most reliable account of Sundarbans. In his Gazetteer Hunter makes certain interesting observations concerning the natural calamities in Sundarbans. He writes that “Natural Calamities, such as blights, floods and droughts, occasionally occur in the Sundarbans, but not often; nor have they, within the experience of the present generation, happened on a scale to seriously affect the harvest of the entire Sundarbans”.

Thus the implicit criterion for “serious” natural calamity, according to Hunter, was one that caused widespread loss of crops. However, the Sundarbans were represented by Hunter as nearly impervious to major crop failures from any cause. In other words, cyclones, floods, famines and tidal surges—the mass killers in the Bengal delta in the present—are regarded complacently by Hunter and his informants.

This is proved further when he writes that the cyclones of 1864, 1867, and 1869, although they inflicted great damage in certain particular localities, were only partial in their effects and did not extend over the whole Sundarbans. What was felt severely in one tract hardly affected another and even in the parts most
severely visited, the destruction was confined to a more or less limited area. Excepting such partial inundations caused by cyclones and storm waves, floods are unknown. Excessive rainfall did not cause inundation. He goes on to vividly describe how the water escaped through sluices into the surrounding creeks and river at ebb tide tide. Moreover, the river and watercourses never rose high enough to overflow the ordinary embankments. He thus claimed that as storm wave and cyclones were not of frequent occurrences, and did not affect the entire Sundarbans, “the Commissioner thinks there is no necessity for large protective embankments than those which already exists.” The embankments constructed by the grantees and landed proprietors were generally four feet high. What Hunter wrote in his Gazetteer is contrary to what we have so far known about Sundarbans’ natural calamities. It is a blatant denial of the occurrence of a natural disaster like the devastating and furious tropical cyclone to which the Sundarbans region is prone. Therefore Hunter paid “little attention” to the natural disasters that nowadays harry the region and even refused to accept the natural calamities like the cyclones, as the “colossal forces active in the Sundarbans.”
But in another place in his Statistical Account, he wrote that “liability to cyclone must put a practical limit to the extension of cultivation, the nearer one gets to the sea, the greater the danger; and more the forest is cleared away, the smaller the barrier placed between the cultivator and the devouring wave”. Thus he clearly warns his readers that clearing of the Sundarban jungles could uproot the protective barrier against such tidal waves and severe cyclonic storms, the occurrence and prevalence of which he dealt with unimportance before. But his statement reminds us that recent experience with cyclones and storms show how important such natural protection are in neutralizing their impact. In fact, besides being an economic resource, the mangrove vegetation provides a natural protection to the lives and properties of the coastal population in cyclone prone Bangladesh and Sundarban West Bengal. Indeed, the mangrove vegetation is known to provide a remarkable stability to the entire system of Sundarbans. Even Tilman Henckell in his letter to the Governor General pointed out that “the Sundarbans fulfils certain purpose such as assurance of protection against erosion by winds and tides among other benefits”. Thus as a shelter belt and as a strong buffer, the mangrove forest protects the Sundarban region against cyclonic storm and tidal surges which logically necessitates their protection.
7.9 Conclusion: Adapting to the Natural Hazards of Sundarbans

The Sundarbans has been affected by earthquakes, strong winds, subsidences, salinity and severe cyclonic storms in the past which have caused widespread devastation to human settlements and have claimed many lives and the loss of much agricultural land. To protect themselves the settlers tried to adapt themselves to these adverse environmental conditions by building embankments and shelters. But often these proved ineffective in the face of colossal cyclonic storm waves. Thus one is forced to think of natural ways to protect a region famous for its bio-diversity and unique eco-system. The present chapter while trying to trace the occurrence of various natural hazards in Sundarbans and their devastating power on human settlements, also tries to stress the importance of preserving the natural vegetation, which acts as a natural buffer and water purifier, in this fragile eco-habitat. While on one hand the colonial government encouraged the clearing of jungles for the sole purpose of generating more revenues, some colonial officials
warned against such reckless deforestation, which meant the removal of natural barrier to such devastating cyclonic storms. Often the colonial government’s attitude to the occurrence of such disasters was casual and questionable. To some extent the relief measures undertaken by the government was half-hearted, lacked dedication and seriousness. The construction of embankments were primarily the responsibility of the zamindars, who often neglected their maintenance. These structures were often too low or were not built scientifically. The scale of natural disasters in Sundarbans prove that any embankments lower than 20 feet would never prove effective.

The dense forest vegetation of Sundarbans provides a natural protection from the harsh natural environmental realities affecting the region. It is now widely believed that ruthless destruction of mangrove forests in the Sundarbans may be one of the major reasons for the recurrence of cyclonic disasters there. For those who have made this land of cyclones, floods, salinity, subsidence their home, it is virtually a story of continuous battle with mother nature for survival. The harsh environmental
realities of Sundarbans has been adapted by them. In the face of growing concern regarding global warming and its diverse results like rise in sea level, more severe cyclonic storms and unpredictable weather conditions, the present chapter becomes more relevant. While one cannot control mother nature, one can surely provide other means of protection so that valuable lives can be saved. It is here that a judicious balance has to be struck between scientific developments in the field of disaster management along with eco-friendly measures of disaster relief. All this has to be combined with local as well as governmental participation. Hence, what is required is a respectful balance between accepting nature’s destructive power with the use of modern scientific methods of pre-disaster predictions and other modern relief measures.
### Table 1

**Frequency of Cyclonic Storms in the Bay of Bengal (1831-1960)**

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<th>Month</th>
<th>Less-Severe</th>
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<tr>
<td>Jan</td>
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</tr>
<tr>
<td>Feb</td>
<td>1</td>
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<td>Dec</td>
<td>26</td>
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<td><strong>Total</strong></td>
<td><strong>314</strong></td>
<td><strong>100</strong></td>
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Source: Directorate of Regional Meteorological Centre, Calcutta
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47. Ranjan Chakraborty-Local People and the Global Tiger: An Environmental History of the Sundarbans- ; Research articles/ Chakraborty

48. A.K. Mandal and Ranjit Kumar Ghosh- Sundarbans: A Socio-Bio-Ecological Study, Calcutta ; Bookland; see introduction


50. M. Hanif- Encyclopedia of Agricultural Geography; pg 153