



## Tropical Severe Super Cyclone Amphan Effects on Coastal Plant Diversity of East Midnapore District, West Bengal

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### ABSTRACT

Present research deals with the effects of deadly Amphan super cyclone on plant diversity in the East Midnapore coastal belt. Super tropical cyclone Amphan made landfall near Bakkhali in 24 Parganas in West Bengal and affected the total coastal area of West Bengal. East Midnapore district Ramnagar-I & II, Contai-I, Deshpuran, Khejuri-II, Nandigram-I, Sutahata Block, and Haldia municipality are the affected areas. Khejuri -II and Nandigram-I block were damaged remarkably. In those two blocks, most old trees were broken, uprooted, or both. Significant loss of plant diversity was occurred by this severe super cyclone. Still, the most predicted point for the landfall of Amphan Digha under Ramnagar-I block was affected in minimum level. It was noted that throughout the Midnapore coastline, manmade vegetation was damaged maximum. Mainly Casuarina and Eucalyptus trees were affected very much. Trees were more damaged rather than shrubs and herbs. Mangrove plants just in front of the sea line were destroyed less than backside manmade terrestrial vegetation.

**Keywords:** Amphan super cyclone, Plant diversity, Landfall, Manmade vegetation, Casuarina, Eucalyptus

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### INTRODUCTION

The coastal area of East Midnapore district is made up of 8 blocks, namely Ramnagar -I & II, Contai-I, Deshpuran, Khajuri-II, Nandigram-I, Haldia municipality, and Sutahata and it occupies 27 % (near about 60KM) of the entire coastline of West Bengal extending from Digha To bank of Rupnarayan river curving Sankarpur, Mandarmoni, Junput, Ruslpur, Khejuri, Nandigram and Haldia (Mandal *et al.*, 2013). East Midnapore coastal belt is rich in biodiversity with its own vegetation and exotic species, which have been natural vegetation adapting coastal environment. Coastal vegetation significantly protects coastal lines from erosion and protects lives from various cyclonic damage and socio-economic status. Also, this coastal area is the treasury of ethnomedicinal plant species (Romero-Martínez *et al.*, 2021). Coastal vegetation is an ecosystem rich in genetic diversity with high environmental value (Banerjee, 1994; Untawale, 1994). Besides, the species play an essential role in protecting the coast from flooding and erosion (Desai, 2000). Super Cyclonic Storm Amphan was a powerful and deadly tropical cyclone that led to extensive damage in Eastern India, particularly West Bengal, and Bangladesh on May-20, 2020. It was the most robust tropical cyclone to strike the Ganga Delta since Sidr of the 2007 season and the first super cyclonic storm formed in the Bay of Bengal since the 1999 Odisha cyclone and the 3rd super cyclone that hit West Bengal since 1582, after 1737 and 1833 ("Amphan: Cyclone wreaks deadly havoc in India and Bangladesh", 2020; Nandi and Thakur, 2020; Bose, 2020). Amphan is also the costliest cyclone recorded in the

North Indian Ocean, surpassing the record held by Cyclone Nargis of 2008, causing over US\$13 billion of damage (Sud & Rajaram, 2020). Cyclone affected coastal areas in West Bengal, including East Midnapur, North 24 Parganas, South 24 Parganas, Kolkata, Hooghly and Howrah, and Odisha. It also caused significant destruction in Bangladesh ("Cyclone devastates Kolkata and leaves scores dead", 2020). Around 5:30 p.m. IST (12:00 UTC), Amphan made landfall as a Very Severe Cyclonic storm near Bakkhali, West Bengal, with winds of 100 mph (155 km/h) on 20<sup>th</sup> May 2020 ("In pictures: Cyclone Amphan hits India and Bangladesh", 2020). As further moving inland, it quickly weakened. Just six hours after landfall, the JTWC (Joint Typhoon Warning Center) downgraded it to a Category 1-equivalent cyclone and issued its final warning on the system as it became disorganized ("Tropical cyclone 01B (Amphan) Warning Nr 018", 2020). Although Amphan severe super cyclone directly hit Bakkhali and the whole coastal area of South 24 Parganas and caused massive damage, the coastal belt of East Midnapore was also affected dangerously, especially Khejuri, Nandigram, and Deshpuran block. Most trees were broken or uprooted, even big trunks of old trees in Khejuri -I and II, Nandigram -I, Deshpuran block had been crushed, most of the manmade casuarinas and Eucalyptus plants were uprooted. Mangrove patches at estuary points were also affected, leaves, branches, flowers, and fruits were crushed, and large-scale damage happened. Due to the high speed of the Amphan, most plants throughout the coastline were leafless.

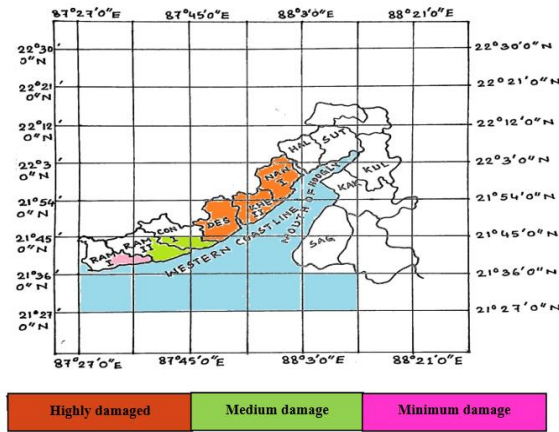
### Aims and objectives

The aims and objective of this research were as follows -

1. Proper investigation of the post-Amphan effect on plant diversity only.
2. Calculate the damage range of vegetation.
3. Preparation of post-Amphan record on account of plant diversity loss.

**Study area**

The study area included the total coastal belt of East Midnapore district covering Ramnagar-I (RAM-I) & II (RAM-II), Contai-I (CON-I), Deshpuran (DES), Khejuri -II (KHE-II), Nandigram-I (NAN-I) blocks. Ramnagar -I & II, Contai-I, Deshpuran, Khejuri-II, and Nandigram-I blocks are more important due to the direct attachment of the Bay of Bengal. 6 studied obstructions and the range of damage were shown in **Figure 1**.



**Figure 1.** Study areas

**MATERIALS AND METHODS**

Field survey and field study are two methods that were applied to construct this article. From 21-05-2020 to 28-05-2020, a continuous field study was conducted from ground zero level. Each coastal block was thoroughly investigated by motorcycle. Direct observation of floral damage and due attention on biodiversity loss was maintained to understand coastal vegetation's damage range better. All procedures were conducted under the supervision of the Ph.D. guide. Nikon Cool Pix L120 camera and German eTrex GPS detecting instrument were handled for proper data collection. Notable specimens were collected, making herbarium specimens for further reference.

**RESULTS AND DISCUSSION**

Severe super cyclone Amphan hit near Bakkhali, South 24 Parganas, and caused a great spoil of diversity. It also damaged the massive loss of biodiversity in the East Midnapore coastal belt. At Kendiamari, Nakchirachar, Gangra and Gangra Jalpai of Nadigram, Khejuri proper, Arakbari, Hijli (Nichkasba) of Khajuri, Petuaghat, Kanaichatta and Bankiput of Despran, Junput and Buguranjalpai of Contai-I, Mandarmoni of Ramnagar-II, Sankarpur and Digha of Ramnagar-I were investigated properly. In Nandigram and Khejuri, the effect of the super cyclone was horrible. Most of the trees were leafless,

the tree trunk was crashed, and most Eucalyptus trees were uprooted; Casuarina trees at Khejuri, Hijli, Bankiput, Junput Tajpur, and Sankarpur were broken and uprooted terrifically. Point to be noted that manmade emerged vegetation (**Table 2**) were damaged highly, and natural mangrove and mangrove associates vegetation (**Table 3**) of the coast were less damaged. The block-wise record was discussed here, and also block-wise damage of vegetation (%) was shown in **Table 1**, and graphical representation of damage (%) was given in **Figure 4**.

**Nandigram -I block:** Kendiamari, Nakchirachar, Gangra and Gangra Jalpai were studied to cover the bank of Haldi River under Nandigram -I block. The maximum portion of the study area is covered by fisheries reducing natural biodiversity, but Gangra and Jalpai Gangra bear a forest belt. Most of the trees were mashed and crashed, especially manmade vegetation was damaged more. Mangrove, mangrove associates, shrub, and herbs were affected less. 75% of manmade and 15% of natural herbs and shrubs were destroyed.

**Khejuri-II block:** Boga, Hijli, Arakbari, and Khejuri proper were the subject of study plots. Plant diversity under this block was much more affected by Amphan. 40-50% of the trees of Khejuri proper were damaged. Most of the *Casuarina* plants near the coastline were either uprooted or crushed. At Hijli, nearly 50% of *Casuarina* plants was damaged, but surprisingly, mangrove patches and natural dune herbs were not much more affected by Amphan. 76% of manmade plants and 15% of natural herbs and shrubs were damaged.

**Deshpran block:** About 50% of trees were damaged, and approximately 75% of manmade vegetation was destroyed by super cyclone Amphan. At Bankiput most manmade plantation (*Casuarian* plants) (**Figure 2**) were damaged, but mangrove plants and mangrove associates (**Table 3**), which protects coastline erosion, were less damaged.



**Figure 2.** Damaged Casuarina plants

At Contai-I, Ramnagar-II, and Ramnagar-I, 10-20% of natural vegetation and 30-40% manmade vegetation was damaged by Amphan. Eucalyptus vegetation at Sankarpur (Ramnagar-I block) was damaged more (**Figure 3**). It was demonstrated that manmade emerged vegetation (**Table 2**), which the forest department or local people planted, is unsuitable for the coastal belt. However, they are economically more benefited, but ecologically they have less impact. Amphan also showed that manmade vegetation accelerated the digester more times

because the broken trees damaged human life, shelter, livestock, electricity, and more. Rather than manmade vegetation, original coastal vegetation has less economic value but has an environmental impact. They can protect super cyclones, even severe super cyclones like Amphan.



Figure 3. Damaged Eucalyptus plants

Table 1. % of damage vegetation block wise

BLOCK	% OF DAMAGE MANMADE VEGETATION	% OF DAMAGE NATURAL VEGETATION
NANDIGRAM-I	75	15
KHEJURI-II	76	16
DESHPRAN	75	17
CONTAI-I	62	12
RAMNAGAR-II	35	9
RAMNAGAR-I	15	4

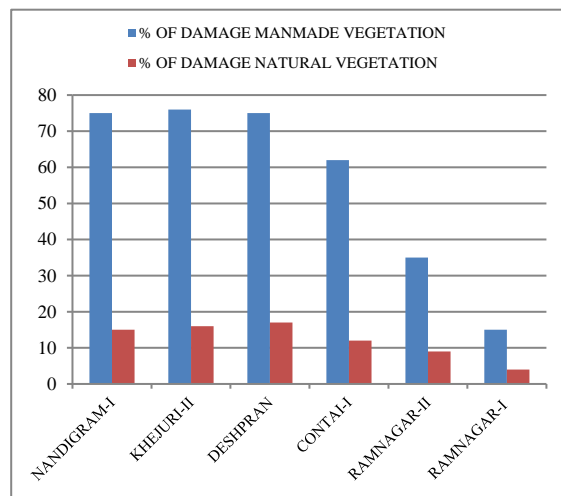


Figure 4. Graphical representation of % of damaged vegetation of the studied area

Table 2. Manmade emerged vegetation in the coastal belt

S.N	NAME OF PLANTS	FAMILY
01	<i>Acacia auriculiformis</i> A. Cunn. Ex Benth	Fabaceae

02	<i>Casuarinas equisetifolia</i> L.	Casuarinaceae
03	<i>Eucalyptus tereticornis</i> Sm.	Myrtaceae
04	<i>Melaleuca quinquenervia</i> (Cav.) S.T. Blake	Myrtaceae

Table 3. Mangrove and associates

S.N.	NAME OF PLANT	FAMILY
01	<i>Acanthus ilicifolius</i> L.	Acanthaceae
02	<i>Arundo donax</i> L.	Poaceae
03	<i>Avicennia marina</i> (Forssk) Vierh.	Acanthaceae
04	<i>Avicennia officinalis</i> L.	Acanthaceae
05	<i>Bacopa monnieri</i> (L.) Pennell	Scrophulariaceae
06	<i>Bruguiera gymnorrhiza</i> (L.) Lam.	Rhizophoraceae
07	<i>Ceriops decandra</i> (Griff.) Ding Hou	Rhizophoraceae
08	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae
09	<i>Desmostachya bipinnata</i> (L) Stapf.	Poaceae
10	<i>Distichlis distichophylla</i> (Labill.) Fassett	Poaceae
11	<i>Dolichandrone spathacea</i> (L.f.) K.Schum.	Bignoniaceae
12	<i>Excoecaria agallocha</i> L.	Euphorbiaceae
13	<i>Fimbristylis ferruginea</i> (L.) Vahl	Cyperaceae
14	<i>Halosarcia indica</i> (Willd.) Paul G. wilson	Amaranthaceae
15	<i>Ipomoea carnea</i> Jace.	Convolvulaceae
16	<i>Ipomoea pes caprae</i> (L.) R. Br.	Convolvulaceae
17	<i>Myriostachya wightiana</i> (Nees ex Steud.) Hook.f.	Poaceae
18	<i>Porteresia coarctata</i> (Roxb.)	Poaceae
19	<i>Rhizophora mucronata</i> Lam.	Rhizophoraceae
20	<i>Salicornia brachiata</i> Roxb	Chinopodiaceae
21	<i>Sesuvium portulacastrum</i> (L.) L	Azioaceae
22	<i>Sonneratia alba</i> Sm.	Lythraceae
23	<i>Suaeda monoica</i> Forssk.ex.J.F. Gmel	Amaranthaceae
24	<i>Suaeda nudiflora</i> (Willd) Moq.	Amaranthaceae

### CONCLUSION

Amphan was the strongest tropical cyclone to strike the Ganga Delta since Sidr (2007) season and the first super cyclonic storm to have formed in the Bay of Bengal since the Odisha cyclone (1999). It was also the 3rd super cyclone that hit West Bengal since 1582, after 1737 and 1833, as well as being the strongest (155km/hours). It is not the last tropical severe super cyclone but it is a sign for near future that such cyclone may occur frequently because global warming is not controlled throughout world. So, it will be happened and we have to think globally but act locally about our existence. Amphan shows that plantation all over coastline is not scientific. Natural vegetation of coastal belt must be planted which can protect the coat line erosion as well as cyclone and they does not cause the secondary digester. Expert's knowledge on costal vegetation and plantation should be applicable and must be

spread to the local people who inhabited in coastal belt. Local govt. body, school student and teachers, as well as college students and teachers can take part to initiative programme to aware local people what kind of plants they can plant surroundings of their houses. Also govt. should take some policy on the matter of typically own coastal vegetation plantation all over coastal area rather than economically valuable plants.

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**CONFLICT OF INTEREST:** As a student of Ecology and Taxonomy, I must search for the hidden cause of the environmental disaster and reopen it to awareness. Amphan is a naturally originated cyclone, but its influence some extends of manmade. Human activities accelerated the range of damage. As a part of the doctoral program on the study of coastal vegetation of East Midnapore, West Bengal, India under the plant taxonomy, biosystematics and molecular taxonomy laboratory, UGC-DRS-SAP & BOOST-WB Supported department, Botany and Forestry, Vidyasagar University author studied the effects of Amphan cyclone, and this paper is the post-Amphan investigation report. This research paper is a complete document of Post Amphan damage and causes.

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**ETHICS STATEMENT:** None

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