

An aerial photograph of a cyclone over the ocean, showing a distinct eye and spiral cloud bands. The colors range from deep blue to white, indicating varying cloud heights and intensities.

# **THE MAKING OF A DISASTER**

**Cyclones, Coastal Vulnerability  
and Community Resilience**

**The Research Collective  
New Delhi**




The Research Collective, of the Programme for Social Action (PSA), facilitate research around theoretical framework and practical aspects of development, sustainable alternatives, equitable growth, natural resources, community and people's rights. Cutting across subjects of economics, law, politics, environment and social sciences, the work bases itself on people's experiences and community perspectives. Our work aims to reflect ground realities, challenges conventional growth paradigms and generate informed discussions on social, economic, political, environmental, and cultural problems.

*This brief report is the compilation of discussions and points raised by speakers and participants of a webinar 'The Making of Disaster: Cyclones, Coastal Vulnerability and Community Resilience' held in September 2021.*

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The Making of Disaster  
Cyclones, Coastal Vulnerability and  
Community Resilience

Brief Report

The Research Collective  
New Delhi

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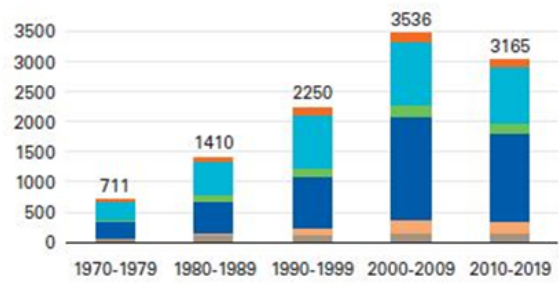
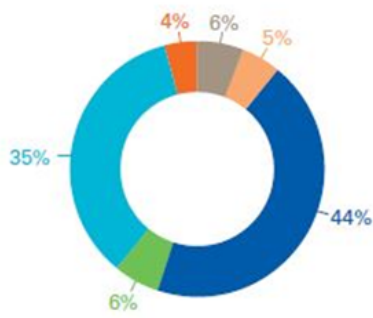
# INTRODUCTION

Extreme weather events have become quite a regular feature over the past few years. These could be intense cyclonic storms, unprecedented rainfall, wild fires, flash floods, extended & intense heat waves and cold waves or even drought like situations. These events are attributable to the climate crisis, possibly the most threatening event perpetrated by humankind as it unfolds on Earth. Catastrophes due to shifting climatic patterns and weather cycles have occurred on Earth since the very beginning, but the scale of destruction, devastation and crises facing humankind is unprecedented and terrifying. The increase in atmospheric and water temperature lead to rising sea level, supercharged storms and higher cyclone wind speed, more intense and prolonged droughts and wildfire seasons, heavier precipitation and flooding.

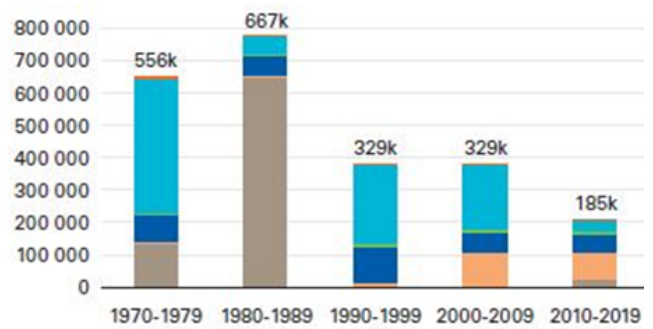
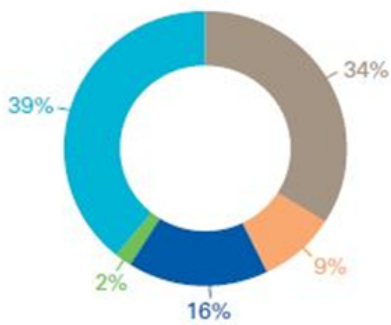
According to a report published by World Meteorological Department in 2021, during 1970-2019, there were more than 11000 reported disasters attributed to these hazards globally with over 2 million deaths and US\$ 3.64 trillion in losses (WMO, 2021, p. 8).



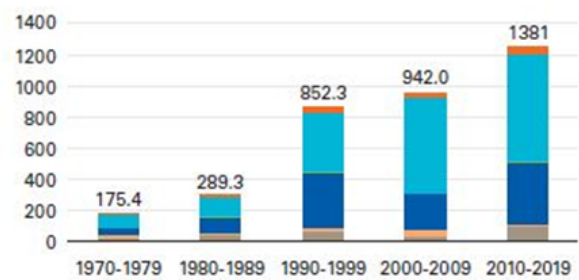
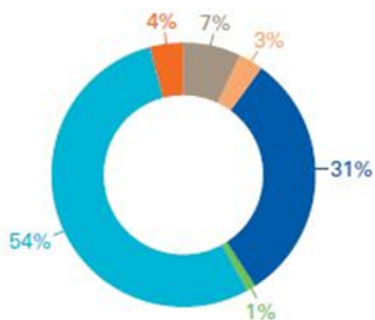
(a) Number of reported disasters  
Total = 11 072 disasters



(b) Number of reported deaths  
Total = 2 064 929 deaths



(c) Reported economic losses in US\$ billion  
Total = US\$ 3.6 trillion



■ Drought   ■ Extreme temperature   ■ Flood   ■ Landslide   ■ Storm   ■ Wildfire

Source: WMO Atlas of Mortality and Economic Losses from Weather, Climate and Water extremes (1970-2019)

The above graph (WMO, 2021, p.19)<sup>1</sup> states that from 1970-2019, weather, climate and water extremes accounted for 50% of all disasters, 45% of all reported deaths and 74% of economic losses. The number of climate-related disaster has tripled in the last three decades. The decadal growth of global sea level rise between 2006 and 2016 is at a rate of 2.5 times faster than it was through the entire 20th century. The United Nations Environmental Program estimates that adapting to climate change and coping with damages will cost developing countries \$140-300 billion per year by 2030.<sup>2</sup> In August 2021, the Intergovernmental Panel on Climate Change (IPCC) published its first part of its sixth assessment report. The landmark report warns of increasingly extreme heatwaves, droughts and flooding and a key temperature limit being broken in just over a decade. The report notes that the global surface temperature was 1.09 degree Celsius higher in 2011-2020 than 1850-1900. The rate of sea level rise has nearly tripled compared with 1901-1971. In addition, past five years have been the hottest on record since 1850. It further adds that the human influence is “Very likely” the main driver of global retreat of glaciers and it is virtually certain that hot extremes including heatwaves have become more frequent and intense since 1950, while cold events have become less frequent and severe. The warming that the earth has experienced to date has made changes to many of planetary support systems that are irreversible on time scale of centuries to millennia.<sup>3</sup>

This brief report is a compilation of discussion held during webinar “**The Making of Disaster: Cyclone, Coastal Vulnerability and Community Resilience**” which is aimed to bring out the challenges faced by the coastal communities, pre and post climate disaster in India. Further, it deliberated on the extent and scope of government response in terms of policy, evacuation and effective role communities play during or after disaster in this era of intensifying climate change.

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1. Douris, J., & Kim, G. (2021). (rep.). Atlas of Morality and Economic Losses from Weather, Climate and Water Extremes (1970-2019) . Geneva, Switzerland: World Meteorological Organization.

2. Oxfam International. (2021). 5 natural disasters that beg for climate action [web log]. Retrieved December 15, 2021, from <https://www.oxfam.org/en/5-natural-disasters-beg-climate-action>.

3. Portner, H.-O., & Roberts, D. C. (2022). (rep.). Climate Change 2022 Impacts, Adaptation and Vulnerability (pp. 11–15). Geneva, Switzerland: Intergovernmental Panel on Climate Change.

During this webinar, discussants from impacted communities, researchers and participants from the different coastal states put forth their experiences of various cyclones that had devastated lives and livelihoods. The community people along with the researchers and experts attempted to explain and understand the causes and effects of natural disasters on coasts and possible pathways to overcome frightful manifestations of climate crisis.



# Cyclones and Coastal Indian States

India's 7500 Km long coastline is frequently battered with pre-monsoon and monsoon cyclones and occurrences of it have only intensified in the past few years. Recent years have seen an increase in the frequency of cyclone winds, rainfall as well as increase in tsunamis. The Indian coastline is vulnerable to these extreme weather events and cyclones have become one of the biggest threats to life and property. As per the World Meteorological Organization (WMO), in the last fifty years, tropical cyclones have killed almost 8 Million people and caused \$1.4 trillion in economic losses worldwide.<sup>4</sup>

During 2018-19, the southern hemisphere, where the Indian Ocean is located, experienced 27 cyclones. The Southern Indian Ocean had 18 cyclones, 13 of which classified as Category I cyclone.<sup>5</sup> The Northern Indian Ocean saw at least three cyclones carrying wind speed of 100 kmph or more. The Arabian Sea, which flanks India in the west, has seen a dramatic rise in cyclones. In 2019, five out of eight cyclones that hit the country emerged there. Similarly, in 2020, India witnessed two severe pre-monsoon cyclones, Amphan and Nisarga, which resulted in economic loss of \$14 Billion in India. In May 2021, India witnessed two cyclones, Tauktae and Yaas, on west and east coast respectively. Cyclone Tauktae categorized as an 'extremely strong' cyclonic storm that hit west coast, particularly Maharashtra and Gujarat. It was the strongest cyclone to make landfall in Gujarat since 1998. It brought heavy rainfall and flash floods to areas along the coast of Kerala and on Lakshadweep resulting in the death of at least 122 people, 81 missing and displaced 2.6 lakh people.<sup>6</sup> The cyclone caused widespread infrastructure and agricultural damage to the western coast, which was valued at more than US\$2 billion.

'Very Severe' Yaas followed cyclone Tauktae on the east coast towards the end of May 2021 and left a trail of destruction in Odisha and West Bengal. Due to heavy rainfall and strong wind, agricultural land was flooded and more than three lakh houses were damaged affecting more than 10 million people in West Bengal alone.

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4. Douris, J., & Kim, G. (2021). (rep.). Atlas of Morality and Economic Losses from Weather, Climate and Water Extremes (1970-2019) . Geneva, Switzerland: World Meteorological Organization.

5. Maximum Sustained Wind speed of 74 mph is a category 1 cyclone according to Saffir-Simpson Scale. There are five categories on this scale where Category 5 is disastrous with speeds exceeding 160 mph. When you draw a distinction based on MSW, be mindful of categories, for disaster management's teams across the world use MSW + Categories to assess their response.

6. The Times of India. (2021). Tauktae killed 122, forced 2.6 lakh evacuation in 6 states: Government". . The Times of India. Retrieved November 21, 2021, from <https://timesofindia.indiatimes.com/india/tauktae-killed-122-forced-2-6l-evacuation-in-6-states-government/articleshow/82816075.cms>.

Across the state, the rising waters breached river embankments in more than 100 locations. In neighboring Odisha, around 120 village settlements were flooded and heavily damaged by the rains.

The densely populated India's 7500 km long coastline is most vulnerable to cyclones and as per the 2011 Census, there are 486 census towns along the coast with a population of 171 million.<sup>7</sup> Several large cities such as Kolkata, Puri, Vishakapatnam, Chennai, Cochin, Goa and Mumbai, and numerous fishing villages and hamlets along the coast have been withstanding the worst of natural calamities. Adjacent to these human habitats, coral reefs, mangroves, tidal mudflats and salt marshes are some of the fragile habitats found along the coastline. Apart from these ecosystems, the coastlines feature a variety of land forms such as sandy beaches, dunes, cliffs and rocks. These ecosystems contribute to the protection of coasts and coastal communities. Over the years, these defensive forces against cyclones has been obliterated by various developmental projects and lack of implementation of protection measures.

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7. Centre for Coastal Zone Management and Coastal Shelter Belt, AU Chennai, Sponsored by MoEF&CC

# Cyclones and Coastal Vulnerability

The issue of coastal vulnerability at the face of frequent tropical cyclones and rising sea levels are result of a group of factors that have been clearly visible and manifesting themselves for past two decades. There are several factors contributing to this phenomenon. The rise in the sea temperature have substantially contributed in level of moisture in air. The intensity of cyclone majorly depends upon the quantity of water vapor going up. With every 1 degree Celsius rise in the sea temperature, there is a corresponding 7% more moisture to the air. According to the IPCC report, the global temperature rose 1.1 degree between 2011-2020 and 1.2 degree Celsius in 2021 over pre-industrial time whereas the landmass temperature rose to 1.5 degree Celsius. This kind of surface warming does not seem much but they significantly increase the level of moisture and when moisture condenses, it gives rise to the heat in the wind mass that further makes way for big storms. It is clear prediction that in coming decade's cyclones will intensify. However, the present trend clearly shows increase in numbers. There are other trends that have been observed based on past five-year data. Cyclones are far more likely on the eastern coast, originating in the Bay of Bengal. Cyclones in the Bay of Bengal can be attributed to the vast low pressure created by the warm water of the ocean. Meteorologist believes that the Bay of Bengal give birth to severe cyclones because it is concave or shallow where when strong winds push water, it gets concentrated as a storm. The Bay of Bengal is shaped like a trough that makes it more hospitable to storms to gain force. Moreover, the high sea surface temperature makes matters worse in the Bay triggering the intensity of the storm.<sup>8</sup> Similarly, the Arabian Sea that flanks India in its west is getting warmer and historically had not many cyclones. During 2010-2021 Arabian Sea had four strong cyclones, giving birth to a new trend.

Another major factor that is further augmenting coastal vulnerability is shoreline changes induced by erosion and accretion of natural processes that take place over a range of time scale.

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8. Saha, S. (2021). Why Bay of Bengal is hotbed of Worst Tropical cyclones? As Yaas hits Odisha, here's all you need to Know. Financial Express. Retrieved November 20, 2021, from <https://www.financialexpress.com/lifestyle/science/why-bay-of-bengal-is-hotbed-of-worst-tropical-cyclones-as-yaas-hits-odisha-heres-all-you-need-to-know/2259192/>.

They may occur in response to short-term events such as storms, regular wave action, tides and winds or in response to long-term events such as glaciation that may cause land subsidence or emergence. Large scale developmental activities along the coast (land reclamation, port development, and shrimp farming), offshore dredging, and sand mining in combination with these natural forces often exacerbate coastal erosion and jeopardize opportunities for coasts to fulfill their socio-economic and ecological roles. The erosion problem becomes worse, whenever the counter protective measures applied are inappropriate, improperly designed built or maintained. This has led to the destruction of natural protection measures such as mangroves, sand dunes and sandy beaches.

Cyclones cause damage through three major ways. These are fundamentally different from each other and do not cause similar damage. Firstly, with the high wind speed the intensity of the cyclone goes up which gives rise to its destructive capabilities. Oftentimes, the cyclones themselves are not destructive but the wind speeds cause severe damage which was observed during cyclone Yaas. Second is the storm surge along with the wind, which brings seawater in huge waves. Lastly, the heavy rainfall inundates most of the affected areas and causes flooding.

Sea surge is the most common form of cyclonic event that is severe because it too erodes the beach and causes widespread destruction on the coast. The installation of hard structures often aggravate the problem instead of enhancing coastal protection. The most erosion is caused by diversion of river flow to coastal areas and loss of mangroves due to unregulated human activities that convert them for agriculture, aquaculture or development purposes.



# Impact of Cyclones on Coastal Communities and Way Forward

In light of rising frequency and reinforced strength of cyclones, communities populating the coastal stretch of India face dire consequences that range from loss of movable or immovable properties, livelihood and in some cases their lives. Over the period, the response measures and disaster mitigation action taken by the government or authorities have improved but these communities are far from being resilient to such calamities.

Before the deadly cyclone in Odisha in 1999, India's cyclone forecasting infrastructure was ineffective and in a bad condition. Since then, upgrade in the use of advanced Doppler radars, launch of weather satellites and use of super computers proved effective in predicting cyclogenesis<sup>9</sup> and forecasting of weather events that helped in saving lives, infrastructural damages and improved warning and evacuation mechanisms. The plight of communities at the forefront of cyclonic disaster is far from over. Here are few challenges that they continue to face.

- **Destruction of critical infrastructure**

Cyclones have a greater impact on the housing, communication, electricity, roadways and many other basic facilities. It also causes huge damage to disaster preventive and protective structures like dams, shelters, embankments and irrigation facilities. The major metropolitan cities located on the coast suffer serious damages. The destruction of critical roadways and communication lines hamper the flow of relief materials, information and ultimately return of people to their respective villages. *"Due to timely dissemination of information related to route and intensity of cyclone Tauktae and rescue efforts, facilitated timely evacuation but widespread infrastructural damages delayed the return of people to their respective villages. They had to spend almost a week in rescue centers"* says MSH Sheikh.<sup>10</sup>

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9. Cyclogenesis is the development or strengthening of cyclonic circulation in the atmosphere. Cyclogenesis is an umbrella term for at least three different processes, all of which result in the development of some sort of cyclone.

10. Speaker in the Webinar, for more details, see list of speakers

As per the Special Relief Commission formed by Odisha Government in 2021, in the wake of Cyclone Yaas, reported estimated loss of Rupees 610 crore to infrastructure Odisha alone.<sup>11</sup> Similar losses were reported in other cyclone-impacted states as well.

The widespread damages have drawn focus for the need of adequate disaster mitigation infrastructure like shelters, all weather roads and embankments in the light of increasing cyclonic storms.

- **Pre/post-response measure and Status of Emergency Shelter Homes**

The government's response is limited to raising warning of cyclones and evacuation measures while inadequate importance is given to post-disaster relief measures to the communities for their loss in properties and livestock. In addition, lack of proper plan in place for post-disaster recovery measure delays the restarting of essential services adding woes in the lives of communities. As per Debasis Shyamal<sup>12</sup> *“despite moderate prediction for cyclone Bulbul, it caused widespread damages and government failed to provide any assistance to the people. This indifference from government prompted villagers to equip and educate themselves which clearly reflected in their preparation during cyclone Amphan”*. He further highlighted the disreputable condition of the rescue centers of West Bengal.

Rescue centers of across coastal states were built decades ago with the assistance of World Bank's National Cyclone Risk Mitigation Project- Phase 1 and Phase 2 (NCRMP)<sup>13</sup> but they were in extremely bad condition. The material used in the construction of shelter homes was of dubious quality. Moreover, the food provided at the rescue center are of bad quality, sanitation and hygiene were not adequately maintained. Due to inadequate roof cover at the shelter homes, the livestock's of affected people too bear similar difficulties and sometimes succumb to prolonged exposure to rain.

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11. T. N. I. E. (2021). Odisha pegs cyclone 'Yaas' loss at 610 crore. The New Indian Express. Retrieved December 20, 2021, from <https://www.newindianexpress.com/states/odisha/2021/jun/03/odisha-pegs-cyclone-yaas-loss-at-rs-610-crore-2311117.html>.

12. Speaker in the webinar. For more details, see List of Speakers

13. <https://projects.worldbank.org/en/projects-operations/project-detail/P092217?lang=en>. Second phase of the project was signed in 2015 and is under implementation

- **Discrimination in the Shelter Homes and Compensation**

People coming from lower castes are subject to discrimination by the people from upper caste. They are subject to comments and sometimes violence at the hand of these people and sometimes not allowed to enter the shelter homes. People have tried to file criminal cases against the perpetrators but authorities refuse to pay heed to their complaints.

Many of the coastal states provide compensation for the loss of crops. According to Sandeep Patnaik,<sup>14</sup> *“In Odisha, eighty percent of people involved in the agriculture sector are sharecroppers and not land owners. Compensation is provided to land owners and not to sharecroppers. People who do not have record of rights, particularly the nomadic tribes that makes them extremely vulnerable and there are no policy provisions for them”*. Moreover, the pace at which financial assistance is distributed to the affected communities has always been a tardy process and is often delayed beyond reasonable time-period.

- **Impact on livelihood**

The over-emphasis on the evacuation measures proved successful in saving lives but at the same time, resulted in massive loss of livelihoods. Fishworkers are dependent on the coast and sea resources for livelihood. *“During cyclones, fishworkers are advised not to venture into the sea in order to save lives. These advisories by Indian Meteorological Department and fisheries department forced fishworkers to not venture into sea for 142 days out of 8 month long fishing season. This is turning into a livelihood issue for fishworkers. The fishworkers are demanding compensation for the losses they incur due to such advisories”* says A.J. Vijayan. However, the compensation and relief provided by the government is not as per the expectation or need of the affected people. Generally, due to coastal vulnerability and disasters, fishworkers are being evicted from the coastal areas and later these vacant lands were used to setup new industries and infra projects. The massive storm surge during cyclone inundates agriculture fields and damages crops.

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14. Speaker in the webinar. For more details, see List of Speakers

15. *Ibid*

16. Mohammed, S. (2019). Coastal Pallithotam Oppose eviction. Deccan Chronicle. Retrieved December 20, 2021, from <https://www.deccanchronicle.com/nation/current-affairs/010319/coastal-pallithottam-fishers-oppose-eviction.html>.

Often, cyclones kick-start distress selling, premature harvesting and create problems for upcoming crops resulting in loss of livelihood of farmers. The inadequate measures to minimize crop damage, assistance for quick harvest and rehabilitation of affected people proves detrimental for these economically marginalized communities.

## **Way Forward**

As much as cyclones are natural disasters, many climatologists as well as people inhabiting the coastal stretch of the country, believe that the large scale human interference with nature to exploit coastal and oceanic resources for commercial ends has exacerbated violent climatic phenomenon and its overall impact. As the world slips further into existential morass due to climate crisis, the frequency of these disasters is increasing on an unprecedented level in recorded history. Even if the technological prowess has yielded in saving lives, massive disruption is caused on property, thus adversely impacting lives of coastal communities in multiple dimensions. Therefore, the obvious question is how coastal immunities stand in resilience to such catastrophes. Do they have any participatory and inclusive role in policies prepared by the authorities to address coastal vulnerability and response measures during disasters. How do central and state governments extend their response in timely manner towards restoration of material and environmental damages caused. These are some of the key questions that people along the coast have been demanding answers for long period of time.

Owing to these issues of the communities at the forefront of cyclonic disaster, depleting natural protection measures and increasing coastal vulnerability demands long-term constructive intervention from the communities, government and civil society. The regular advocacy activities with the state and union government over the issues of the disasters management and post disasters rehabilitation measure need to be fortified. The disaster management policies of the governments need to be looked critically and communities should be included in disaster management planning and coastal protection. Whereas, peoples' organization or fishworkers organization required to take more concentrated action efforts to critically analyze development projects or protective infrastructures on the coast.



These organizations and communities can play an instrumental role in raising awareness on the issue of coast, its ecology, natural coastal processes and traditional understanding of coastal protection and climate crisis. Keeping these points in mind, workshops and public meetings on the issue of climate crisis, coastal ecology and marine infrastructure is the need of the time.

## List of Speakers

Savita Vijayakumar, an Environmental Researcher, associated with The Research Collective, moderated the session. The list of speakers are as follows:

1. Soumya Dutta - a people's scientist associated with people's movement and struggles for more than 4 decades. He is Executive Committee member of Friends of Earth- India, Co-Convener of South Asian Peoples' Action on Climate Crisis (SAPACC) and former advisory board member of UN Climate Technology Centre and Network.
2. Debasish Shyamal – belongs to the fishworkers' community of West Bengal. He is the vice-president of Dakshinbanga Matsyajibi Forum (DMF) and working on the issue of small-scale fishworkers for the past 15 years.
3. MSH Sheikh - Coordinator of Brackish Water Research Center is based in Surat, Gujarat. He has been working on the issue of industrial pollution on the coast of Gujarat and its impact on the fishworkers community.
4. A. J. Vijayan -a researcher based out of Kerala and has more than 4 decades of experience of working with the fishworker community. He has been instrumental in analyzing impacts of coastal policies and neo-liberal development projects on the coasts of India.
5. Sandeep Patnaik – works with Centre for Public Policy Alternatives, based out of Bhubaneswar, Odisha. He has played a significant role in coordinating Civil Society response during the cyclone Fani and created a collective for humanitarian action during disasters in collaboration with the government and district administration.

## References:

1. Douris, J., & Kim, G. (2021). (rep.). Atlas of Morality and Economic Losses from Weather, Climate and Water Extremes (1970-2019) . Geneva, Switzerland: World Meteorological Organization.
2. Oxfam International. (2021). 5 natural disasters that beg for climate action [web log]. Retrieved December 14, 2021, from <https://www.oxfam.org/en/5-natural-disasters-beg-climate-action>.
3. Portner, H.-O., & Roberts, D. C. (2022). (rep.). Climate Change 2022 Impacts, Adaptation and Vulnerability (pp. 11–15). Geneva, Switzerland: Intergovernmental Panel on Climate Change.
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6. T. N. I. E. (2021). Odisha pegs cyclone 'Yaas' loss at 610 crore. The New Indian Express. Retrieved December 20, 2021, from <https://www.newindianexpress.com/states/odisha/2021/jun/03/odisha-pegs-cyclone-yaas-loss-at-rs-610-crore-2311117.html>.
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