

Living with Recurrent Cyclones: Spatial Change, Cumulative hazards and Historical Experience of Coastal West Bengal

Ekanki Pathak

Research Scholar, India

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ABSTRACT

There is considerable spatial variation in major consequences to cyclones along the Indian coast, arising due to the interaction between recurring hydro-meteorological risks and socio-economic and infrastructural damages. In this paper, we analyze changes in the risk associated with cyclones in 99 coastal districts of India between 2012 and 2023, specifically focusing on coastal West Bengal. District-level hazard indices based on the factors of cyclone frequency, occurrence of intense cyclones, peak winds, maximum possible storm surge, and extremes in precipitation were analyzed through equal interval classification and transition matrices. The above-mentioned data are discussed within the context of historical analysis of coastal West Bengal for the years 1991-2021. Findings reveal a national increase in the hazard proneness caused by cyclones, where 37 districts moved to a higher level of hazard, while 61 did not change their positions at all. Intra-regional inequalities are evident in West Bengal, which includes districts like Howrah, Kolkata, and North 24 Parganas moving from a Moderate to a High level of hazard risk, Purba Medinipur escalating from a Very High to Extremely High cyclone risk, while South 24 Parganas, maintaining Extremely High levels, holds the highest total score among all other districts in 2023. Analysis of historical data shows that recurring cyclones have a cyclical effect on communities due to systematic destruction of housing and livelihoods, embankment breach, forced displacement, paralysis of infrastructure, and unequal recovery patterns after the disaster.

Keywords: cyclone; coastal Sundarbans; disaster; vulnerability; livelihoods; India.

1. Introduction

The impact of cyclones in coastal India produce damage beyond the meteorological events itself that involves complex linkages with destruction of housing, livelihood, agriculture, fishery, embankment, period of displacement, and uneven recovery over years as well as across regions (Narang et al., 2026; Pal et al., 2024, Mishra et al., 2020). Though the atmospheric event may

last for several hours, but its consequences may continue for months or years and through a damaged house that can become a reason for displacement; a destroyed crop leading to debt or food insecurity; a damaged boat can remove the means of earning; and a breached embankment can transform an agricultural landscape into saline or inundated land. The differentiation is especially significant in the case of coastal West Bengal, where the Sundarbans and the surrounding coastal districts represent a unique landscape of interplay between nature and humans, and the interaction between tidal river systems, embankments, agricultural activity, fishing, settlement patterns and livelihoods of families is very strong. From the historical point of view, it appears that there have been many cyclonic disturbances in this part of West Bengal. For example, there was one cyclonic disturbance in 1995 which affected the areas of Midnapore and South Twenty-Four Parganas. In 1998, there was a very severe cyclonic disturbance which passed through Sagar Island impacting about 25,000 people in eight villages of Sagar and South Twenty-Four Parganas (RSMC, 1995; RSMC, 1998). However, the prolonged history of disasters becomes especially relevant when recent disasters are taken into account. The area has been hit by a succession of cyclones ranging from destructive cyclones in 1995 and 1998, to Aila in 2009, Fani and Bulbul in 2019, Amphan in 2020 and finally Yaas in 2021, all occurring in an environment that has been previously impacted by losses (Mondal, 2022; Tenhunen, 2023; Mondal 2024). The conception of vulnerability that guides this study is rooted in well-established disaster-risk literature, namely, the pressure-release model of Blaikie et al., 2004 and the more general social construction of disaster risk literature (Pelling, 2003; Tierney, 2014). This literature underscores the point that vulnerability is not simply the result of natural hazards but something determined through accumulated socioeconomic and spatial conditions throughout history. In this way, we conceive of the recurrent occurrence of cyclones as cumulative hazards whose repetition can possibly influence pre-existing vulnerability structures and reproduce them over time. "Historically reproduced vulnerability" is therefore used in this study to describe the process whereby vulnerability is sustained and reproduced as the result of social and spatial differentials in regions that experience repeated exposure to cyclonic hazards, and not as some kind of deterministic outcome of such exposure.

The combination of evidence in this paper comes from two sources. First is a database of damage ratings of cyclones in coastal districts during two periods of observations, 2012 and 2023, along with their categorization. Second is an ethnohistorical study of the coastal West Bengal, and the period under interpretation goes back from 1991 to 2021. The data on districts serves for a general comparison across India geographically, while the information about West Bengal gives the depth of time and society.

The main questions discussed in this paper include: (1) How did the categories of cyclone damages differ between 2012 and 2023 for coastal districts of India? (2) Where is there

continuity, increase, stabilization or decrease? (3) In what respects is West Bengal unique among coastal states? and (4) What is the significance of experience in West Bengal coast in the context of cyclical disasters? The main conceptual issue is that spatially persistent damage by cyclones and persistently exposed population are two distinct but related concepts. From the score analysis we know where there is persistent or increasing damage, from the historical analysis we understand how persistent damage is interrelated with housing, livelihoods, infrastructure, displacements, memories and recoveries. The main significance of this paper is in its attempt to combine a geographical and an historical issue.

2. Data and Methodological Approach

The quantitative component uses district-level cyclone hazard proneness for two observation periods 2012 and 2023. The Indian Meteorological Department (IMD) provides two reports on cyclone hazard proneness of Indian coastal districts namely, “Cyclone Hazards Prone Districts of India, 2012 and Cyclone Hazard Climatology, 2023. Reports contain district names, categorical classification of cyclone proneness with rating scores on the basis of five parameters; total number of cyclones, number of severe cyclones, maximum wind speed, probable maximum storm surge, and, probable maximum precipitation. The observation is therefore cross-sectional at two points rather than a continuous annual time series.

The second component is a documentary-oriented reconstruction of coastal West Bengal. It uses Regional Specialized Meteorological Centre reports and newspaper material contained in the supplied historical write-up. The main analytical period is 1991–2021, while earlier evidence is retained selectively as historical background because it demonstrates that the social and infrastructural landscape encountered by communities in the 1990s was itself shaped by earlier cyclone experience. The method is therefore best described as historical analysis rather than conventional participant-observation ethnography.

The two forms of evidence are deliberately kept analytically distinct. Numerical data answer the geographical question of spatial difference; documentary material illuminate the social meaning of recurrent damage. The paper does not use the qualitative material to claim statistical causality, nor does it treat the cyclone risk as a substitute for lived experience.

A further limitation follows from the available district data. Because numerical observations are available only for two periods, the paper cannot establish whether a district's score increased continuously, declined temporarily and then recovered, or fluctuated between the two dates. The 2012–2023 comparison should therefore be read as a spatial transition analysis rather than a temporal trend analysis.

3. The Spatial Geography of Cyclone Damage: India, 2012 and 2023

In order to observe any changes that could be brought about by the occurrence of cyclones among the 99 coastal districts in the two different periods of 2012 and 2023, the 99 coastal districts were categorized into five levels of scores on the basis of five cyclone parameters by IMD. The study has used these scores by scale and origin shift so that the mean becomes 50 and Standard Deviation becomes 10 and categorize them into: low, moderate, high, very high and extremely high risk of cyclone hazard using an equal-interval method based on the combined range of scores of 2012 and 2023 (Majumder et al., 2025). This led to the identification of thresholds for the categories that included: Low ($<2.016 - 17.412$), Moderate ($>17.412 - 32.807$), High ($>32.807 - 48.203$), Very High ($>48.203 - 63.598$) and Extremely High ($>63.598 - 78.994$). The category thresholds were defined with reference to this standardized distribution. Thus, the thresholds of 40, 50, 60, and 70 correspond approximately to -1 SD, the mean, $+1$ SD, and $+2$ SD, respectively. This approach provides substantively interpretable thresholds and ensures consistency across the different indices and time periods. The combined score does, however, have its limitations. The weighting is based on the IMD approach not based on the estimation of the weights using damages or socio-economic impacts. Also, the combined score accounts for the hazard but not disaster risk, since the disaster risk will need to account for the factors such as exposure, vulnerability, capacity to cope and adapt to the disasters.

From the distributions, there is evident change towards high scores in relation to cyclone scores from 2012 to 2023. In 2012, the number of districts in the low category was 41 (41.4%) and 50 (50.5%) in the moderate category compared to just 5 (5.1%) and 2 (2.0%) districts in the high and very high categories and 1 (1.0%) district in the extremely high category. However, by 2023 the number of districts falling into the higher category had increased (Table 1). The other thing that is revealed by the transition matrix is that 37 districts (37.4%) have recategorized into higher range, while one district (1.0%) has worsened its score category and 61 districts (61.6%) have retained their score category (Table 2 and 3).

The state vs district-level analysis clearly indicates significant spatial differences among districts in terms of temporal changes in scores for cyclones between 2012 and 2023. Even though according to the transition matrix for all the states and union territories there is an increase in categorization from 37 out of 99 districts, there is a large difference in terms of the amount of change for coastal states and union territories. The most pronounced transition occurred in Andhra Pradesh and Gujarat with eight districts increasing their categories in each of these states. For Andhra Pradesh, there was an increase in the number of High districts from one to seven and in addition to it, Krishna moved from Moderate to Very High. On the other hand, in Gujarat there was a decrease in the number of Low districts from seven to two and an increase in the number of High districts from zero to four. Moreover, the district of Rajkot moved straight

from Low to High. Another important state with some interesting upward transition is Odisha where Cuttack moved from Low to Moderate, Ganjam and Puri from Moderate to High and Jagatsinghpur and Kendrapara from High to Very High. On the other hand, Tamil Nadu saw a less pronounced but more widely spread increase in the category status with Chennai progressing from Low to Moderate and Cuddalore, Nagapattinam and Thiruvavur from Moderate to High categories. Contrary to this, the states of Kerala, Karnataka and Goa exhibited significantly lesser levels of reclassification with numerical increases in cyclone-related scores not leading to an increase in categories. The state of West Bengal exhibits especially peculiar regional patterns. Thus, Howrah, Kolkata and North Twenty-Four Parganas increased from Moderate to High, and Purba Medinipur from Very High to Extremely High categories. South Twenty-Four Parganas was characterized by the extremely high category and attained the highest score for 2023 (78.994). On the contrary, Paschim Bardhaman experienced a decrease in category status from Moderate to Low. It is the only area among the 99 districts that showed a decrease in the category status. Overall, district-level data suggest the highly localized nature of the increase in cyclone-related scores observed at the national level with some eastern and western coastal areas exhibiting pronounced reclassifications while other parts staying relatively stable.

Table 1. Classification thresholds and distribution of districts

Category	Score range	2012 (n)	2012 (%)	2023 (n)	2023 (%)	Change
Low	2.016–17.412	41	41.4	28	28.3	–13
Moderate	>17.412–32.807	50	50.5	40	40.4	–10
High	>32.807–48.203	5	5.1	25	25.3	+20
Very High	>48.203–63.598	2	2.0	4	4.0	+2
Extremely High	>63.598–78.994	1	1.0	2	2.0	+1
Total		99	100.0	99	100.0	

Table 2. 2012–2023 category transition matrix

2012 / 2023	Low	Moderate	High	Very High	Extremely High	Total 2012
Low	27	11	3	0	0	41
Moderate	1	29	19	1	0	50
High	0	0	3	2	0	5
Very High	0	0	0	1	1	2
Extremely High	0	0	0	0	1	1
Total 2023	28	40	25	4	2	99

Table 3. Direction and magnitude of category change

Change from 2012 to 2023	Number of districts	Percentage
Declined	1	1.0%
No category change	61	61.6%
Increased by 1 category	32	32.3%
Increased by 2 categories	5	5.1%
Increased by 3+ categories	0	0.0%
Total	99	100.0%

4. West Bengal: Persistent and Intensification of Cyclone Hazard

Spatial comparison between the districts of West Bengal and other coastal districts of India shows considerable difference in terms of scoring regarding cyclones with a gradient going from the relatively low scores of the inland districts to the extremely high scores of the coastal districts. There is much variability within West Bengal and its exposed coastal districts occupy score ranges which are comparable to the highest scoring districts of Odisha and Andhra Pradesh.

Lower scores in West Bengal, such as Bardhaman and Hooghly, are in the Low category both in 2012 and 2023. These districts' relatively low scores separate them from the highly exposed coastal districts of southern West Bengal. It shows that the cyclone-related conditions in West Bengal are not homogenous spatially. These districts are generally comparable to the relatively low scores of other coastal states, such as Dhenkanal and Keonjhar in Odisha and Idukki and Kottayam in Kerala. The intra-state variability is significant as inclusion of West Bengal in the

cyclone-prone eastern coast does not mean that all districts have the same level of cyclone-related vulnerability or exposure.

There is a rise in the cases of Howrah, Kolkata and North 24 Parganas that have progressed from Moderate to High categories from 2012 to 2023. The movement in the classification boundary suggests a rise in the score values for cyclones in the study area. In terms of the entire nation, the 2023 score value for these areas puts them at a level equivalent to that of certain districts of Andhra Pradesh and Odisha such as Guntur, Prakasam, Srikakulam and Ganjam. Even though these districts do not lie at the topmost position of the distribution, their change from Moderate to High suggests that there has been a rise in the conditions for cyclones.

The most pronounced pattern, however, is observed in **Purba Medinipur and South 24 Parganas**, which occupy the upper end of the West Bengal distribution. Purba Medinipur recorded a score of **57.018 in 2012**, placing it in the **Very High category** (>48.203–63.598). By 2023, its score had increased substantially to **75.288**, resulting in a transition into the **Extremely High category** (>63.598–78.994). This signifies an important upward shift above the category threshold and shows how Purba Medinipur district was transformed into a highly cyclone-prone district from being a district with very high cyclone-prone status. This is so owing to the geographic position of Purba Medinipur within the northern Bay of Bengal, which makes it necessary to compare this district with neighbouring districts in Odisha, including Balasore, Bhadrak, Kendrapara, and Jagatsinghpur, who have also been recognized as highly or very highly cyclone-prone districts in national studies. The similarity between both districts is also due to the geographic continuity of the coastal environment in terms of hazards, which include cyclones, storm surges, coastal flooding, erosion and salinity processes.

South 24 Parganas provides an illustration of even greater persistence on the opposite end of the distribution. The district had a score of 64.571 in 2012 that increased to 78.994 in 2023, placing the district in the category of Extremely High in both periods. Though Purba Medinipur entered this category during the course of study, South 24 Parganas was already part of the category by scoring higher than the threshold value of the Extremely High category, 63.598, in 2012. By 2023, the district managed to secure the highest score among all districts of the national distribution. Therefore, the two districts can be viewed as examples of different kinds of change in the high-end: Purba Medinipur is a case of intensification through the shift from the Very High category to the Extremely High one; South 24 Parganas exemplifies persistence and intensification in the Extremely High category.

In summary, the spatial gradient and intensification in time is evident in the case of West Bengal with respect to cyclone scores. While Bardhaman and Hooghly continue to remain in the Low

category, Howrah, Kolkata, and North 24 Parganas shift from Moderate to High category, Purba Medinipur shifts from Very High to Extremely High, and South 24 Parganas continues to be Extremely High with a maximum score in 2023. Inter-state comparison reveals that the districts belonging to upper-end category in West Bengal are similar to those belonging to highly cyclone-prone districts of Odisha and Andhra Pradesh with regard to score range. However, the continued position of South 24 Parganas in the Extremely High category and elevation of Purba Medinipur into Extremely High category bring out the emerging spatial concentration of risks associated with cyclone on the southern and eastern coastal sectors of West Bengal. The results clearly emphasize the significance of district-level spatial analysis in contrast to state-level analysis that could hide considerable differences between coastal and inland districts.

5. Coastal West Bengal as a Historical Landscape

The nature of cyclone-induced hazards in coastal West Bengal in the modern era can be seen in relation to the historical interaction between the recurring cycle of cyclones, the environment, infrastructure and livelihoods. From the ethnography and history of the region, it appears that the Sagar, Kakdwip, Namkhana, Patharpratima and other areas of the Twenty-Four Parganas were characterized by a long history of cyclone destruction, erosion of embankments, displacements and livelihood loss at the time of entering the 1990s. Earlier experiences had made it clear that the cyclone threat was not only associated with the lives of people but also their houses, farms, animals, electricity, communications and transport. During the 1990s, too, two major events took place with a severe cyclonic storm hitting Midnapore and South Twenty-Four Parganas in 1995, leading to death, damages to around 300 kutch houses and loss due to fishing industry, while the very severe cyclonic storm of 1998 hit near Sagar Island and affected around 300,000 people in South Twenty-Four Parganas, damaging thousands of houses (RSMC, 1995; RSMC, 1998). This is further evident that cyclone hazard in the region is a recurring element of the lived environment. The importance of such losses in terms of history becomes evident from historical viewpoint, because a house means more than a physical structure listed in the damage report; rather, it means more than a center of family life, possession, food, documents, safety and continuity. It follows that the loss of a home sets off a process that could be long-term, involving relocation, rebuilding expenses, livelihood interruption and new ways of living. Later cyclones continued this trend, because the 2002 cyclone affected the Sagar region, and the 2007 cyclone brought about heavy rains, crop destruction, electrical disturbance and other effects on many coastal villages (RSMC, 2002; RSMC, 2007). **In 2009, Aila was another significant milestone in this history of the area, resulting in deaths, tidal and riverine floods, extensive damage to housing and crops, loss of property, and displacement, with some 1.5 million people affected in West Bengal (RSMC, 2009). Aila is an example that disasters are processes in time rather than events, in which initial displacement could be followed by food insecurity,**

costs for reconstruction, lower agricultural productivity, and disruption of livelihoods. The link between water and habitation is especially significant in the Sundarbans, where tidal water serves both as a resource for ecology and livelihood and causes inundation, salination, and destruction. In 2015, the experience of Cyclone Komen showed how disasters affect everyday life, as damages to mud houses, crop losses, closure of schools for a limited period of time, and ban on fishing interfered with normal everyday activities in Canning, Gosaba, Patharpratima, Sagar, and Namkhana. In other words, disasters often disrupt people's lives; fishermen cannot use the sea, cultivators do not have their crops, people do not have housing, children are deprived of schooling. The implications of such physical threats vary in accordance with livelihood systems in households; destruction of a fishing boat might pose grave danger to fishing-based households, whereas agricultural losses will have varying implications in terms of landholdings, savings, other sources of income, and migratory options. Additionally, cyclones Fani and Bulbul that hit the region in 2019 show how disaster governance underwent an important change in recent times. In the case of Fani, about 234,801 individuals had been evacuated from the state of West Bengal without any reports of deaths, indicating substantial improvements in both the capacity to predict disasters and evacuation process; however, about 29,260 houses and 112,000 hectares of agricultural land had been destroyed (RSMC, 2019). Therefore, this disaster demonstrates an important paradox of adaptation where death rates could decrease whereas vulnerability persists. **Cyclone Amphan in 2020 is an example of how such vulnerabilities are interlinked, with floodwater affecting low-lying areas, fatalities, widespread destruction of homes and infrastructure, and disruption of power and communication lines impacting millions of people (RSMC, 2020).** This disaster occurred amid the pandemic situation, making the impact of the disaster even more severe, as people had to cope with both disasters simultaneously. Therefore, one can say that impacts of cyclones do not just include physical destruction but also the interconnected networks of movement, communication, water sources, education, business and livelihoods. Another example of the recurrence of risks is the cyclone Yaas in 2021, with strong winds, storm surge, and heavy rainfalls affecting Purba Medinipur and South Twenty-Four Parganas, despite the fact that the cyclone had crossed through Odisha Coast. **Many croplands were damaged, as well as hundreds of thousands of houses, millions of people have been affected (RSMC, 2021).** The cycle starting from Aila and ending with Yaas implies that even if there have been significant improvements in disaster preparedness, warnings and evacuation procedures, recurring cyclones still cause considerable losses. It is because the vulnerability now is not limited to death tolls and displacement but includes the loss of livelihoods caused by destroyed homes, agricultural production, disruptions in communication and electricity, income interruptions and a long recovery process. Frequent embankment breaches are another factor contributing to persistent losses. In the flat coastal areas,

embankments play an important role in safeguarding people from tidal water. However, in case of a breach, it leads to flooding and huge livelihood losses. In historical analysis, it is important to recognize that the embankment is not only an engineering work but an actual boundary between land and water. It brings both security and an element of sudden environmental change. The state of the embankment impacts the people's settlement and agriculture, as well as risks perception, while its breach increases the effects of the temporary event of the cyclone. In summary, the historical data adds to the results found at the district level because they illustrate how the repeated physical hazard turns into social and economic vulnerability through housing conditions, livelihoods, displacement, infrastructure, embankment and recovery processes. The high score of the cyclone-related variables in the districts of West Bengal (South Twenty-Four Parganas and Purba Medinipur) should be seen not just as the proof of the repeated physical hazards but as the result of the historically established interaction between cyclones, the coastal environment and infrastructure. The two elements, quantitative and historical, can be combined by interpreting the changes that occurred in the vulnerability score in the context of the historically accumulated conditions in the studied area. On the one hand, the vulnerability score accounts for cyclone risk; on the other hand, the historically accumulated documentary evidence explains how such conditions have been developing due to the recurrent cyclones, displacement, disruption of livelihoods, environmental changes, and uneven recovery. This way, it cannot be said that the higher vulnerability in the case of South 24 Parganas is caused by the number and frequency of cyclones, but rather by the interaction of such hazards with existing social and spatial disparities. Therefore, the historical information about the disruptions in livelihoods, settlement, and local environment allows explaining why the vulnerability stays localized in certain areas. In this way, the documentary evidence does not independently explain the numerical value but rather interprets the processes and conditions reflected in its socio-economic elements.

6. Comparative Discussion: India and the West Bengal Experience

The nationwide analysis of districts and the ethnography of West Bengal address different aspects of the same issue. The district-level analysis indicates that cyclone destruction is not evenly spread throughout coastal India. There are multiple cases of change from Moderate to High, while other districts maintain High and some remain relatively unchanged. West Bengal includes persistence as well as intensification: Purba Medinipur and South Twenty-Four Parganas stay High, while Howrah, Kolkata and North Twenty-Four Parganas change from Moderate to High.

This particular case shows how the need for spatial persistence calls for historical explanation. South Twenty-Four Parganas would not be a high damage region in the quantitative dataset without the history behind it. This area has been hit by repeated cyclones, suffered damage to

housing, displacement of people, crop failure, embankment failures and livelihood interruptions over many years. The numerical score reflects the current status of the disaster-scarred landscape.

However, this comparison is not meant to suggest that West Bengal stands out in every way from other states in India. Odisha has continuing high-damage areas; Andhra Pradesh and Gujarat have many moderate-to-high transitions; Tamil Nadu has extensive intensification; and other coastal regions have some stability. What is important about West Bengal is the richness of historical information available on what constitutes continuing damage.

This produces a multi-scalar approach. At the national level, the question becomes one of geography: where are patterns of cyclone damage persistent or changing? At the regional level, the question becomes one of history: why does damage continue in certain landscapes? At the household/community level, the question becomes one of ethnography: how are continuing losses and anticipation woven into everyday life?

It also indicates that adaptation needs to be conceived as a process that is differentiated. The Fani case highlights the fact that evacuation and emergency measures have been effective in reducing deaths, while the cases of Amphan and Yaas have revealed the existence of a significant level of vulnerability in terms of assets and livelihood. Therefore, the goal of adaptation cannot be limited to survival from the cyclones' landfall; it also has to involve the ability to protect livelihood, rebuild houses, maintain infrastructure, and recover from debt or deprivation of assets.

The major implication of this research for theory is that vulnerability should be considered as a phenomenon reproduced through history rather than an isolated event. While each cyclone may inflict new damages, it also interacts with the aftereffects of former cyclones.

7. Conclusion

In this paper, we have seen the integration of both the spatial study of cyclone damage at the Indian district level through a two-period comparison and the historical trend of coastal West Bengal. In terms of the district analysis, it can be observed that the cyclone damage varies spatially and districts face different dynamics in terms of persistency, intensification, stability, and declination. West Bengal possesses persistent high-damage districts, such as South Twenty-Four Parganas and Purba Medinipur, along with those whose numerical value and categories have improved.

Here lies the true significance. In coastal West Bengal, there has been a cycle of disasters where cyclones keep making an intrusion in people's daily lives through such means as housing

destruction, crop loss, disruption of fishing, livestock loss, embankment damage, electricity, and communication problems, displacement, and long-term recovery processes. Examples like Aila, Fani, Bulbul, Amphan, and Yaas show a shift in the scenario for disaster management where there is improvement in preparation and evacuation but still vulnerability remains.

The main idea is that vulnerability to cyclone disasters in coastal West Bengal does not happen in a new way after every disaster. Rather, it happens due to the interplay between repeated environmental disturbances and people living in the same environment where the consequences of the disasters continue to exist. The question posed by the historical trend is different from that which is asked in the hazard assessment. While the latter may end its analysis of where cyclone damage is greatest, the former examines the impact of persistent damage on local social relations, the influence of prior disasters on future ones, reconstruction of daily routines, and mediation through infrastructures like embankments of the interaction between humans and nature. In this regard, the critical factor in coastal vulnerability is not only the experience of the cyclone but also the inevitability of recurrence.

In terms of disaster governance, the lesson is as critical for risk reduction in the long run. Evacuation and early warning measures to reduce fatalities are key, yet measures to improve housing conditions, livelihood stability, embankment upkeep, crop production, infrastructure strength, and capacity of families to rebuild their homes without damaging their production capabilities are also important. The geography of cyclone damage can help to locate priority areas, while ethnography may be useful to determine what interventions would be relevant to people who live in these areas.

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