



From cyclone management to community resilience: An empirical study of Cyclone Fengal 2024 in Puducherry, India

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Abstract

Cyclone Fengal, which struck the Union Territory (UT) of Pondicherry in late November 2024, offers a critical opportunity to evaluate the efficacy of India's institutional disaster management framework at the sub-national level. This paper presents an empirical study examining the shortcomings of the current management approach and the consequent need to build long-term cyclone resilience. Employing a primary data collection method through structured surveys with affected residents, the study assesses public perception across key dimensions of the disaster response cycle: early warning dissemination, government assistance, and community engagement. The findings reveal a mixed but instructive picture. The state apparatus performed credibly in areas requiring top-down coordination, with respondents reporting reasonable satisfaction with the early warning systems, the timeliness of news dissemination through official channels, and the provision of post-disaster government assistance. However, the analysis exposes a significant structural deficiency: the management strategy largely failed to institutionalise civil society partnerships and grassroots community participation in preparedness, response, and recovery planning. This gap indicates that the prevailing model remains predominantly government-centric and reactive, rather than collaborative and anticipatory. The paper argues that such an approach, while adequate for immediate relief, is insufficient for cultivating durable resilience against increasingly frequent and intense cyclonic events linked to climate variability. Drawing on the Fengal case, the study recommends a paradigm shift toward a decentralised, community-inclusive disaster management model that formally integrates local institutions, civil society organisations, and citizen volunteers into all phases of the disaster management cycle, thereby strengthening both state capacity and societal resilience in coastal India.

Keywords: Cyclone Fengal, Cyclone resilience, Disaster management, Disaster governance, Community resilience, Community participation, Disaster risk reduction, Puducherry, India

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1 Introduction

India, with its vast geographical territory, is known as a sub-continent. It has rich geographical and socio-cultural diversity, from the Himalayas in the north to the coastal region, spanning thousands of kilometres in the south. The Indian coastline is distributed among nine states and four union territories, namely Maharashtra, Gujarat, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, West Bengal, Odisha, Pondicherry, Daman and Diu, Lakshadweep, and Andaman and Nicobar Islands (Ramesh and Bhatt, 2018). Until recently, India officially had a coastline of

7516 km; however, a recent review of India's coastline by the National Hydrographic Office and the Survey of India found that India has a coastline of 11098 km (Survey of India, 2024). India is encircled by the North Indian Ocean (NIO), with the Arabian Sea bordering the west and the Bay of Bengal delineating the east (Balachandran et al., 2008). India's thousands of kilometres of coastline, high population density in the coastal region, and shallow continental shelf make it highly vulnerable to cyclones (Jena, 2017). Of the entire coastline of India, approximately 5,700 kilometres is susceptible to cyclonic activity. Overall, 8% of

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India's total land area is vulnerable to cyclone-related disasters. Although the frequency of cyclones in the NIO region is not very high, the eastern coast of India has witnessed 21 of 23 super cyclones over the past 280 years, resulting in thousands of deaths and massive destruction of tangible assets along the coast (NDMA, 2008, p. XXIV). India is among the nations severely impacted by tropical cyclones, experiencing an average annual loss of approximately 2% of its GDP (Ranjan and Karmakar, 2024).

India had a contingency approach to cyclone management, with no concrete policy addressing cyclones for more than five decades. Funds for cyclone response and relief to states were provided through the margin money scheme and the calamity relief fund following such events (Sharma, 2022). India adopted a disaster management approach by enacting the Disaster Management Act (DMA) of 2005. In a way, disaster was a late entrant into India's governance structure. India's participation in the Yokohama Conference in 1994 and the Hyogo Framework for Action (2005–2015) served as catalysts for developing disaster governance mechanisms. The DMA 2005 provides for the development of a culture of disaster preparedness and response by establishing disaster management authorities at the central/state/and district levels. However, it was in 2008 that the National Disaster Management Authority issued guidelines for managing cyclones. The additional initiative in this area is the National Cyclone Risk Mitigation Project (NCRMP), launched with financial assistance from the World Bank (PIB, 2025). The NCRMP has four components of mitigation, namely i) creating an early warning dissemination system, ii) cyclone risk mitigation infrastructure, iii) technical assistance for capacity building on disaster risk management, and iv) project management and monitoring. The NCRMP has been implemented in two phases across eight coastal states of India; however, Pondicherry (Pondicherry refers to the Union Territory as a whole, while Puducherry refers to the Puducherry district in the UT) is not included in either phase (NDMA, 2015, p. 8). Although Pondicherry is not covered under the NCRMP, the World Bank initiated the “Tamil Nadu and Puducherry Coastal Disaster Risk Reduction Project” in 2012, which ended in 2020. The objective of the project was “To increase the resilience of coastal communities in Tamil Nadu and Puducherry to a range of hydro-meteorological and geophysical hazards, along with improving Project Implementing Entities' capacity to respond promptly and effectively to an Eligible Crisis or Emergency.” The total cost of the project was 236 million U.S dollars. The World Bank worked in close collaboration with the nodal disaster management authorities in Tamil Nadu and Puducherry. The project built the first-of-its-kind wireless communication early-warning system for fishers at sea (World Bank, 2021).

The disaster management approach puts the government machinery ahead and keeps the community largely out of it. This is how even disaster is defined by the DMA-2005: a natural or man-made event that is beyond the *community's coping capacity*. Hence, the community is already kept outside the scope of disaster governance. However, the need of the hour is to shift from management (government-led) to

disaster resilience (community-oriented). Cyclone resilience signifies a qualitative transition in which community action, economic activities, the strengthening of existing infrastructure, and the protection of the community ecosystem are integrated into a continuum. Cyclone resilience does not depend solely on government actions and machinery. In addition, it prepares the community as a whole to absorb the shock of the cyclone, adapt by learning from past events, and recover efficiently (Wang et al., 2022). Disaster management increases the community's dependence on and expectations of the government, as the cyclone is seen as beyond the community's coping capacity. It makes people passive observers and look to the government to set up shelters and provide essential needs like water and food for displaced people. It is the government that provides financial assistance for loss of life, physical damage to infrastructure, and economic losses to individuals. The loss of public property and community buildings, such as schools, hospitals, roads, and colleges, is also at the mercy of the government. There is a complete political economy of disaster management in which disasters provide the government with scope to out-source reconstruction work to private players and turn it into a business. In contrast to the management approach, Cyclone resilience refers to the capacity of a community to prepare for anticipated cyclones with its learnings from the past and with the resources it has. It is the community members who identify vulnerable groups, arrange local shelters, store essential food items, and manage alternatives for the supply of electricity and water. Economic activities are restored at the earliest, and cyclone-resilient infrastructure is promoted to minimise economic losses. The most important part of cyclone resilience is the community ecosystem, where, in addition to human life and infrastructure, the flora and fauna are also taken care of. It ensures that minimal damage is done to the existing flora and that part of the community fauna, including cattle, street dogs, and cats, is not only provided with shelter during the cyclone but also with water and food in the post-disaster stage.

The present study empirically examines the management of Cyclone Fengal in Union Territory (UT) of Pondicherry during November–December 2024 and concludes that this approach suffers from many shortcomings. Through empirical observation of the management of Cyclone Fengal, the research finds that almost the entire Cyclone Fengal in Pondicherry was managed by the government, and the community has remained a mere spectator, dependent on the government for individual needs and for the community's losses. It was the government that was fully active during the pre- and post-cyclone stages, and community members were advised to stay inside. The paper is divided into three major parts. The disaster management plan of Pondicherry, its administrative profile, and its vulnerability to cyclones are thoroughly analysed in the first part. The second part empirically examines the Pondicherry government's response to managing Cyclone Fengal in terms of early warning, emergency contact, and rehabilitation measures. The gaps in disaster governance are investigated, and moving past cyclone management to cyclone resilience is strongly argued in the third part of the paper.

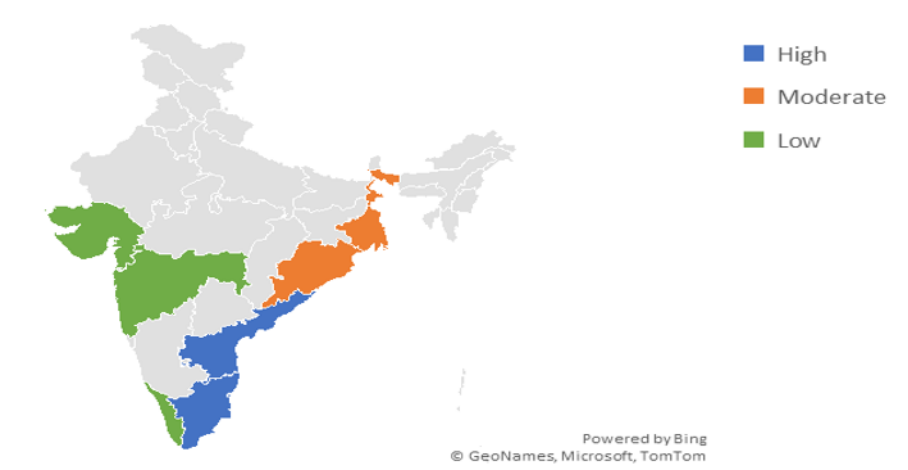


Fig. 1. Cyclone vulnerability of the states in India. Source: NIDM (2021).

2 Pondicherry: A Brief Profile

Pondicherry was under French control when India became independent in 1947. Following independence, the Indian government sought to strengthen India's unity by integrating the erstwhile princely states and territories under foreign control into the Indian Union. Although the agreement for the cession of Pondicherry to the Indian Union was signed in 1954, it was only in 1963 that it officially became part of India (Desai, 2020). Since its integration, Pondicherry has remained a Union Territory encompassing four regions: Karaikal, Mahe, Yanam, and Puducherry. The combined area of the union territory is more than 479 sq. km, with a population of more than 1.2 million (Census, 2011). Pondicherry lies between 11°42' and 12°30' N, and between 76°36' and 79°53' E. Pondicherry is one of the union territories with its own legislative assembly. There are 33 legislative assembly seats, of which 30 are elected, and the remaining 3 are nominated by the central government (Roy, 2021). For administrative convenience, the Puducherry district is divided into four subdivisions: North Puducherry, South Puducherry, Mahe and Yanam. It has four taluks, namely: Bahour, Villinaur, Puducherry, and Ozhukarai, and two sub-taluks, Mahe and Yanam. In addition, it has 13 Firkas and 92 revenue villages (Puducherry - 81, Mahe - 5, and Yanam - 6) (Government of Puducherry, 2024). Flat plains characterise the physiography of Puducherry with an average elevation of 15m above sea level. The region is intersected by the deltaic channels of the River Gingee and the Pennaiyar, along with other streams, forming the two main drainage basins, interspersed with lakes and tanks. Eleven drains and canals in the Puducherry district form the core of its drainage system. Puducherry, the capital of the union territory, is surrounded by the Bay of Bengal on one side, with a coastal length of around 25 kilometres and by Tamil Nadu on three sides. Its urban governance comprises two municipal bodies: Puducherry municipality, with 42 wards, and Oulgaret municipality, with 37 wards. While around 40% of the total population of the UT is engaged in agricultural activities, Puducherry has emerged as an attractive destination for tourists, leading to a boost in the contribution of tertiary activities in its economy. The

UT has a higher concentration of urban population than the national average.

2.1 Cyclone Vulnerability of Pondicherry

The United Nations Office of Disaster Risk Reduction (UNDDR) defined vulnerability as 'The conditions determined by physical, social, economic, and environmental factors or processes which increase the susceptibility of an individual, a community, assets, or systems to the impacts of hazards'. Pondicherry is described as a coastal union territory with a coastline of around 45 km. Of the 45 km, the Puducherry district has a coastline of 25 km along the Bay of Bengal. As a coastal district, Puducherry is highly prone to natural disasters (Department of Science, Technology and Environment, 2013). Puducherry is highly vulnerable to tsunamis and cyclones and moderately vulnerable to fire, flood, and industrial hazards (Sarda and Bahadure, 2021). Puducherry is a low-lying area with a gentle slope, making it susceptible to inundation. The Bay of Bengal is one of the six regions in the world where high-intensity tropical cyclones originate (Government of Puducherry, 2024, p. 9). Cyclones have emerged as a major cause of disruption of normal life in Puducherry. Cyclone vulnerability of a region or community is defined as 'its sensitivity to be exposed or degree of loss due to lack of capabilities (coping and adaptive)' (Boragapu et al., 2023). Fig. 1 shows the cyclone vulnerability of India's coastal states.

Underlying the severity of cyclones in Puducherry, Sethuram (2024) states, "The region's low-lying topography and flat terrain make it particularly vulnerable to storm surges and flooding that accompany cyclonic storms originating from the sea. Factors such as sea-level rise, changing coastal dynamics, and socio-economic activities further exacerbate these risks." In recent years, normal life in Puducherry has been disrupted by various cyclones. The United Nations divides natural disasters into two broad categories: *dis-astrum* and *kata strophe*. While *dis-astrum* is a Latin term, it refers to disasters of low frequency and high intensity; on the other hand, *kata-strophe* is a Greek term, and it refers to disasters of high frequency and low intensity (Global Assessment Report on Disaster Risk Reduction,

2015, pp. 25–28). In this way, the cyclone of Puducherry fits more into the category of dis-astrum, as can be seen in the case of the 2004 tsunami, which caused the deaths of hundreds of people and the destruction of vast property.

Pondicherry has a rich history of encountering cyclones. In 2011, the southeastern coast was hit by “Cyclone Thane”. The cyclone mainly affected Cuddalore and Puducherry, causing widespread damage. The cyclone killed more than 50 people, of whom 12 deaths were registered in Puducherry (Kumar et al., 2012). Puducherry was cut off from its neighbouring districts of Tamil Nadu due to the uprooting of trees, causing a blockade in road connectivity (Punithavati et al., 2012). Cyclone Thane was the first high-intensity cyclone to hit Puducherry since the 1950s (Sundarapandian et al., 2014). In 2020, the southeastern coast was hit by “Cyclone Nivar,” which originated in the Bay of Bengal. The cyclone made landfall on 25 November and mainly affected Tamil Nadu, Puducherry, and southern Andhra Pradesh (Jain, 2020). Though no deaths were reported in Puducherry, the cyclone disrupted power supply and road connectivity to neighbouring areas in Tamil Nadu. Several housing colonies and people living in low-lying areas suffered from waterlogging due to heavy rainfall (PTI, 2020). Section 144 was invoked as a precautionary measure in Puducherry to restrict the movement of people until the cyclone passed (Ray, 2020). Cyclone Mandous, which originated in 2022, along with Puducherry, affected several districts in North Tamil Nadu and Southern Andhra Pradesh. In Puducherry, no casualties were reported, but as many as fifteen houses were destroyed in the Pillaichavady area due to high tides (The New Indian Express, 2022). There was serious erosion on the Pillaichavady coast due to high tides caused by the cyclone. People affected in the area also protested by blocking roads to draw the administration's attention to ongoing coastal erosion and to demand immediate action to ensure coastal protection (Dutta, 2022). In 2023, Cyclone Michaung caused heavy rainfall on the southeastern coast of India. The cyclone made landfall between Nellore and Machilipatnam on 5 December. As a precautionary measure, Section 144 was imposed in the coastal areas of Puducherry to prevent people from the threat of Cyclone Michaung (Dominique, 2023). In addition to imposing Section 144, the government closed schools and colleges in Puducherry. Since 2010, Puducherry has been affected by several cyclones, causing both human and infrastructural losses. The Puducherry administration dealt with these cyclones using a management approach in which learning from the past was negligible and absorption capacity was not increased; rather, the cyclone response was ad hoc, lacking resilience by failing to integrate the community into responding to cyclones.

2.2 District Disaster Management Plan of Puducherry: Analysing the Institutional Structure

The Disaster Management Act (DMA) 2005 laid special emphasis on the role of district administration in the effective management of disasters in India. The role assigned to district authorities makes micro-level disaster management more effective. Section 31(1) of the Act states, ‘There

shall be a plan for disaster management for every district of the state,’ to be called a District Disaster Management Plan (DDMP). The Pondicherry government lagged in executing the district-level plan. It was only in 2015 that the government formulated an exclusive disaster management plan for the Puducherry district. The district plan is reviewed and revised annually by the government, taking into account past disaster events. Every year, the government puts forward the plan before the onset of the Northeast monsoon (Government of Puducherry, 2024). The vision laid by the Puducherry District Disaster Management Plan 2024 is ‘Making disaster resilient Puducherry district by enhancing the capacity of all stakeholders to respond to the disasters in a planned way to minimize loss of lives, livelihood, and economy, including critical infrastructure, basic services like health and education and Socio-cultural and environmental loss.’

The DMA 2005 provides an elaborate, hierarchical institutional mechanism for the effective management of disasters. The institutional mechanism is based on a top-down approach, in which the National Disaster Management Authority (NDMA) is the apex body responsible for disaster management, and the district administration is the central point for implementing all government plans and policies. At the district level, the District Disaster Management Authority (DDMA) acts as the district planning, coordinating, and monitoring body. In Puducherry, the DDMA is chaired by the District Collector and consists of seven other members. There is also a State Emergency Operation Centre (SEOC) in Pondicherry responsible for disseminating disaster-risk-related news to vulnerable populations. The SEOC is situated in the capital of the union territory; thus, it also works as the district emergency operation centre for the Puducherry district.

2.3 Cyclone Management Plan for Pondicherry: From Warning to Relief Measures

The Pondicherry government has provided an action plan for cyclones in the “State Disaster Management Plan.” The main aim of the action plan is to enhance the response mechanism to reduce the effects of cyclones. The Department of Revenue and Disaster Management (DRDM) of the Pondicherry government serves as the nodal authority for disaster management. The rest of the departments extend their support and cooperation to the DRDM in managing cyclones. Fig. 2 shows the major actors involved in cyclone management in Pondicherry.

In the event of cyclones, the primary responsibility falls to the DRDM, the Relief and Rehabilitation Commissioner, and the District Collector. The role of the community is not included in cyclone management, as administration is considered to bear the onus and responsibility for securing communities in the event of a cyclone. This is the major shortcoming of the management approach, in which too much power is concentrated in the hands of the administration, and top-down control (Parsons et al., 2016) and regulation are considered more efficient at responding to the cyclone. The action plan also includes a detailed description of the cyclone warning system, as shown in Fig. 3.

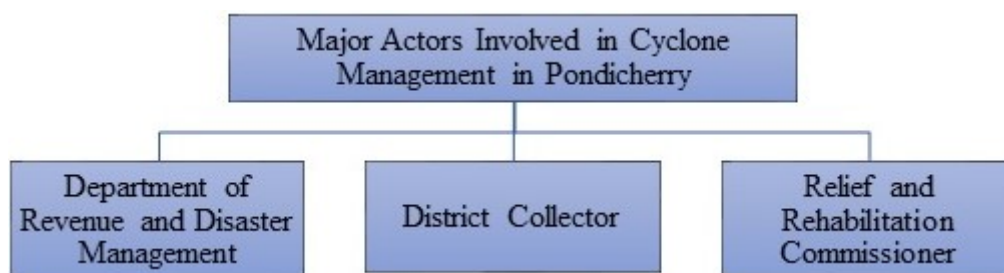


Fig. 2. Major actors involved in cyclone management. *Source:* Government of Puducherry (2024).

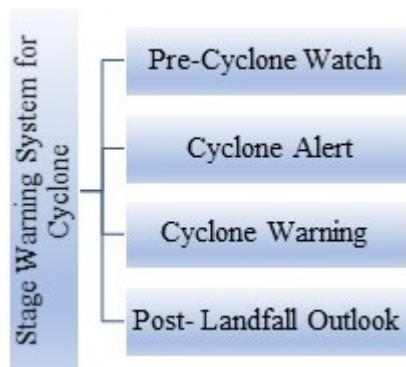


Fig. 3. Stage Warning System for Cyclones. *Source:* Government of Puducherry (2024).

Any information related to cyclones is transferred by the Indian Meteorological Department (IMD) to the SEOC. It is the SEOC's responsibility to disseminate the information to the relevant authorities. In response to the information, the cyclone response structure is activated in the region. All the relevant departments remain prepared to handle the challenges posed by cyclones. In the post-cyclone recovery phase, the relief measures are divided into three parts: short-term measures, interim measures, and the assessment of loss/damage and relief needs. Short-term measures include search operations, rescue missions, and medical assistance to people in need. It also includes emergency relief measures such as establishing temporary shelter homes, providing essential services, and deploying mobile hospitals. Interim measures include assessing casualties and missing-person reports and taking the required actions to ensure a swift response. Assessment of loss/damage includes preparing the damage and loss assessment report along with the relief need report by the District Collectors. A critical examination of the action plan for cyclones in Pondicherry reveals that it focuses heavily on the post-cyclone management and strategies.

3 Impact of Cyclone Fengal: The Government's Narrative

Cyclone Fengal was one of the worst cyclones to hit Puducherry in recent years. The cyclone made landfall near Puducherry on 30 November 2024. Apart from Puducherry, the cyclone affected several districts in Tamil Nadu and Andhra Pradesh. The Union Territory received around 50 cm of rainfall, the highest ever in the past thirty years. Be-

fore the cyclone's landfall, the Puducherry administration implemented various measures to mitigate and prepare for the effects of the cyclone. The IMD issued a red alert for the southern states, with coastal districts such as Mahabalipuram, Karaikal, and Puducherry particularly vulnerable (Hindustan Times, 2024-11-30). To address the severe impacts, the central government deployed 16 National Disaster Response Force (NDRF) teams in the region. Of these sixteen teams, two NDRF teams were deployed specifically in Puducherry (Disaster Management Division, 2024).

The cyclone inflicted heavy damage in the Union Territory, resulting in its declaration as a natural calamity-affected area. As per the government assessment, the cyclone damaged more than four thousand houses and wreaked significant destruction on public infrastructure, including roads, transportation, schools, and colleges (Dutta, 2024). The rainfall induced by the cyclone resulted in waterlogging and flooding of several areas in the UT, making it difficult for people to evacuate the impacted areas. Overflowing of the Uppanar Canal and Kankan Lake worsened the situation and resulted in water stagnation (Perier, 2024). To initiate the recovery of the havoc inflicted by the cyclone, the Chief Minister of Pondicherry asked for a relief package of 614.88 crores from the central government. The assessment report by the government highlights the lack of resilience in the union territory against cyclones. Pondicherry administration failed to learn from the past and kept avoiding the inclusion of the community to adapt, absorb, and recover from the cyclone in a resilient way. It has a management-driven approach that fails to identify that while Pondicherry has been affected by various cyclones in the past, the UT has still failed to work on the cyclone-resilient infrastructure. The issues of cyclone-led inundation and destruction of infrastructure raise serious questions about the resilience measures taken by the administration in the region. The UT is frequently affected by cyclones, putting a heavy strain on the funds available at the disposal of the government. Cyclone resilience is the need of the hour for Pondicherry to prepare for future cyclone events, and there is a requirement to shift focus from post-cyclone recovery to pre-cyclone strategy, with active involvement of the community, which was missing in the overall management of Cyclone Fengal. In addition to the government assessment, empirical data have been collected to provide a more vivid picture of the government's approach and people's perspective in the aftermath of the cyclone.

4 Methodology

This study employs a mixed-methods (quantitative-cum-qualitative) research design that integrates three interrelated analytical components: (i) a review and analysis of the existing cyclone management policy framework of Puducherry; (ii) an assessment of its operational implementation during Cyclone Fengal; and (iii) an empirical investigation of its shortcomings, based on primary data gathered from affected communities in the Puducherry district. The qualitative dimension draws on the lived experiences and perceptions of affected respondents. The quantitative dimension enables systematic analysis of these experiences against established disaster management and resilience frameworks. The study aims to identify gaps in the prevailing cyclone management approach in the context of Cyclone Fengal. It also examines how greater community participation could enhance the region's capacity to anticipate, absorb, and recover from future cyclonic events. The study was conducted across all four taluks of Puducherry: Bahour, Villianur, Puducherry, and Ozhukarai, to ensure representation across the district's administrative and geographic divisions. A two-stage purposive-cum-snowball sampling technique was adopted. In the first stage, within each of the four taluks, the localities that were most severely affected by Cyclone Fengal were purposively identified and prioritised for inclusion in the sample. The identification of these high-impact areas was based on preliminary damage assessments, media reportage, and consultation with local administrative and community sources. This step was necessary to ensure that the sample adequately captured the experiences of the population most exposed to and impacted by the cyclone. Since it is this group whose accounts are most diagnostic of the shortcomings in the existing management approach. In the second stage, within these purposively identified localities, snowball sampling was used to locate and recruit individual respondents. This technique was considered appropriate given the absence of a readily available sampling frame of affected households in the immediate aftermath of the disaster, and the consequent need to reach respondents through referral networks within the affected communities. The combination of purposive and snowball sampling thus allowed the study to ensure both substantive relevance (by concentrating data collection in the worst-affected areas of each taluk) and practical feasibility (by enabling access to respondents through community referrals). It is acknowledged that this non-probability sampling approach may limit the statistical generalisability of the findings; however, it is well-suited to the exploratory and diagnostic objectives of the present study. A total of 100 respondents were surveyed across the four taluks, comprising 40 males and 60 females. A sample of 100 respondents is statistically adequate for stable descriptive and regression-based analysis in survey research. It also appropriately balances analytical rigor with the practical constraints of time, accessibility, and resource limitations inherent in post-cyclone fieldwork in Puducherry. From each taluk, 25 respondents were surveyed, primarily from the most affected villages identified in government reports. The data was collected within one month of the disaster. Pri-

mary data was collected using a structured questionnaire comprising both closed-ended and open-ended questions, administered to respondents in the identified localities.

5 Results and Discussion

Based on the responses received, a wide range of outcomes were recorded. From early warning to post-cyclone response from the government, people expressed their viewpoints on the way Cyclone Fengal impacted their lives. A mix of reviews was received on the way the government tackled the post-cyclone situation. These findings are discussed in detail below.

Table 1. Early warning reception.

Response	Early Warning Message from the Government
Yes	100
No	-
No Response	-
Total Respondents	100

The researchers found that the government warned residents of the Puducherry district about the incoming cyclone, as shown in Table 1. All respondents gave a positive response when asked about the early warning message from government officials about the cyclone. Furthermore, the respondents acquired information about the cyclone from a variety of sources. Among those sources, SMS from government officials, television news channels, and social media were the most used, according to the survey. The data shows that the existing early warning system works effectively in Puducherry. It is part of adaptation to consider how technology can be advanced and utilised to predict the onset, landfall, and impact of a cyclone in the coastal region. Timely warning for the vulnerable population is a critical short-term disaster mitigation measure (GSDMA, 2014, p. 24). Approximately 30% of the damage caused by a disaster can be reduced if early warning is issued within 24 hours (WMO, n.d.). The community can engage in disseminating information to every member and begin preparing for its impact on flora and fauna, as well as recovery efforts (Kovalevski, n.d.).

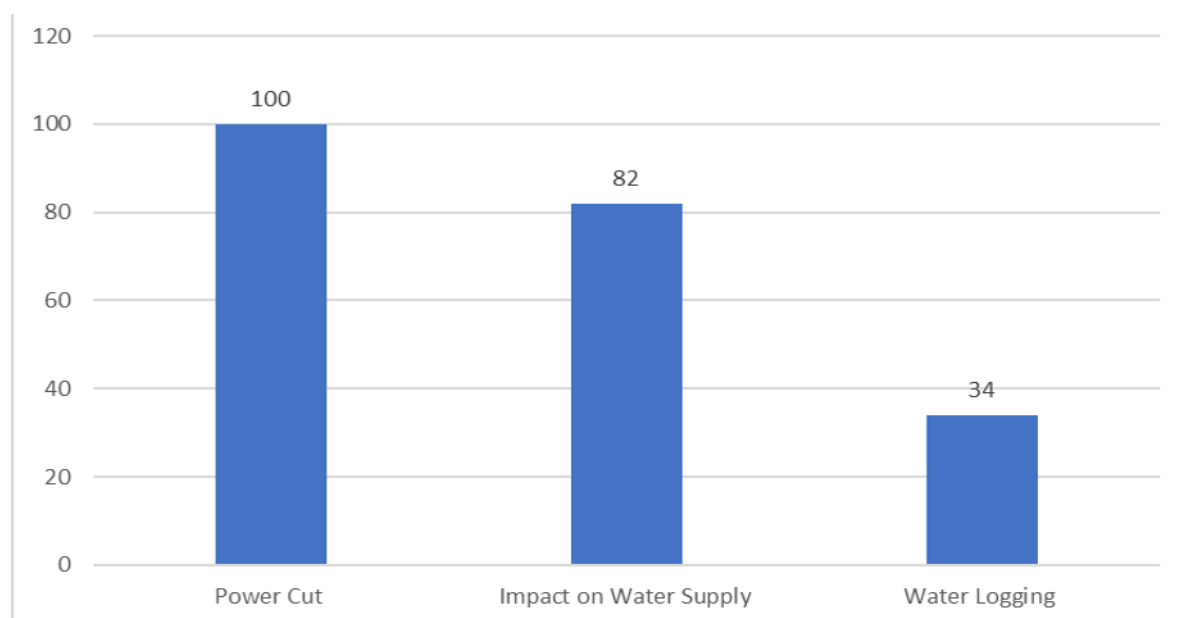
Table 2. Opinion on the government's pre-cyclone strategy.

Response	Any steps taken by the government to prepare for the impact of the cyclone (in numbers & percentage)
Yes	42
No	16
No Response	42
Total Respondents	100

Table 2 presents the respondents' opinions when asked about the steps the government took to address the cyclone's impact. Out of the total respondents, 42% said that precautionary measures were taken by the government. Some respondents said that they were shifted from low-lying areas to safer places by the police. Respondents in-

Table 3. Availability of emergency contact number and list of shelter homes.

Response	Any emergency contact numbers shared by the government	Any list of shelter homes shared by the government
	In numbers and percentage	In numbers and percentage
Yes	80	66
No	20	34
No Response	-	-
Total Respondents	100	100

**Fig. 4.** Problems faced by people due to Cyclone Fengal.

involved in fishing-related activities argued that government officials asked them to abstain from venturing into the ocean amid cyclone warnings. Around 16% of respondents argued that the government took no steps to prepare for the cyclone's impact, and around 42% abstained from answering the question. The observed reluctance of individuals to respond to this specific inquiry prompts an examination of their familiarity with and access to information regarding the government's pre-cyclonic strategies. However, even the Central Industrial Security Force (CISF) has reported that local people are doing 80% of the rescue and search operation. This local involvement in identifying safer places and the timely migration of vulnerable communities is missing from the administrative-led cyclone management approach.

The Pondicherry government maintained that emergency contact numbers and a list of shelter homes were shared with the residents of Puducherry. The researchers found that the majority of respondents refuted the government's claim, as shown in Table 3. Around 80% of the respondents claimed that the government shared emergency contact numbers. At the same time, 20% of respondents argued that the government officials shared no such numbers. For the list of shelter homes, 66% of respondents favoured the government, while 34% opposed it. Availability of the emergency contact number and their response vary from place to place, as there were a few influential regions

where response time was quick in terms of restoring electricity, and attending to medical emergencies. On the other hand, many regions experienced delayed responses and were at the mercy of private service providers for water and feed for their cattle, and so on.

Cyclone Fengal left a severe impact on Puducherry and its nearby areas. Puducherry district received around 50 cm of rainfall due to the cyclone, the highest in the past thirty years. The cyclone disrupted the daily lives of Puducherry residents, who faced numerous problems, as shown in Fig. 4. Among all the problems, the respondents highlighted three major issues. All respondents reported that there was no electricity in the district for several hours to 3 days, making it difficult to carry out daily activities. Around 82% of respondents reported a water supply shortage due to the cyclone. They faced difficulty obtaining a sufficient water supply for drinking and other household activities. In various low-lying areas of the district, waterlogging caused by heavy rainfall became a major problem. Around 34% of the respondents faced problems due to waterlogging, hindering transportation and vehicular movement. Apart from these problems, other problems highlighted by the respondents included communication issues due to network issues, difficulty procuring daily necessities, and road damage that narrows the normal road, resulting in traffic jams. For example, in the Moolakulam region, one road was damaged.

Table 4. Assistance offered by the government and civil society organisations after the cyclone.

Response	Assistance from the government in the post-cyclone situation	Assistance from civil society organisations	Visit by local leaders after the cyclone for impact assessment
	In numbers & percentage	In numbers & percentage	In numbers & percentage
Yes	48	20	64
No	26	80	30
No Response	26	-	06
Total Respondents	100	100	100

The administration took more than six months to repair it. These issues can be addressed with community involvement, as the community has past experience, can mobilize resources, and can motivate people to engage to bring about a solution (Kato, 2021), rather than looking to the administration for support.

The researchers also collected information about post-cyclone assistance from the respondents, as shown in Table 4. Around 48% of respondents said that they received help from the government after the cyclone hit. While 26% of respondents claimed that the government provided no help, 26% of respondents abstained from answering this question. When asked about the kind of help provided by the government immediately after the cyclone, respondents reported receiving 5 kilograms of rice. Regarding civil society organisations, only 20% of people said they received help, while 80% said they received no help. Support from civil society organisations remained marginal. 64% of respondents reported that local leaders visited their areas after the cyclone to conduct impact assessments. While 30% of respondents reported that no leader or official visited their region after the cyclone, 6% abstained from answering the question. The impact of the cyclone varies, and the assistance required by the affected people cannot be the same. The vulnerable group, their losses, and the assistance required can be assessed effectively by local communities, including panchayats, resident welfare associations, local religious trusts, and other civil society actors (TISS, 2005, p. 4). There are multiple social actors, such as Kuddle Life Foundation, the trusts of local temples like Vinayaka Kovil Trust in White Town, and the Aurobindo Ashram Society and Auroville Foundation, that can be engaged to achieve cyclone resilience through their well-established structures. In the aftermath of Cyclone Fengal, the SARVAM, a part of the Sri Aurobindo Society focused on rural development, initiated a relief programme that assisted 500 affected families across 12 villages in Puducherry (Sri Aurobindo Society, 2024). However, the participation of civil society organisations in the cyclone management in Pondicherry has remained marginal.

Financial assistance to the affected community is a major component of disaster response. The Pondicherry Chief Minister, after the cyclone, announced Rs. 5000 per family as a rain relief package to all ration card holders in the affected areas. Research findings indicate that the government fulfilled its promise regarding financial assistance without delay, as shown in Table 5. Among the respondents surveyed, 96% reported receiving the financial assistance promised by the government. Only 4% of respondents said

they did not receive any financial assistance from the government. Additionally, the government pledged five lakh rupees in assistance to the families of those who lost their lives in the cyclone. Here, the 15th Finance Commission's report on Disaster Risk Funding needs to be discussed. Whenever a disaster strikes, in addition to the allotted quota under the State Disaster Response Management Fund (SDRMF), the affected state demands special financial assistance from the central government. Even in the case of Cyclone Fengal, the Pondicherry government has requested Rs. 614.88 crore in financial assistance. The 15th Finance Commission, in Chapter 8 on Disaster Risk Funding, recommended that states explore alternative funding sources, such as issuing reconstruction bonds, corporate funding, and crowdfunding (FC-XV, 2020, pp. 253–54). Cyclone resilience can be attained by avoiding the populist measure of providing relief to everyone, as it lacks beneficiary mapping and identification.

Table 5. Benefits of the financial scheme initiated by the government for all ration card holders.

Benefits of the Rs. 5000 scheme promised by the government	Response
In numbers & percentage	
96	Yes
04	No
-	No Response
100	Total Respondents

One of the major impacts of the cyclone's havoc was on the livelihoods of the local population. The cyclone profoundly affected the daily-wage labourers and fishermen, making it difficult for them to procure daily necessities, as shown in Fig. 5. According to the survey, 20% of respondents reported being unable to go to work on a single day. Most participants (54%) reported disruptions to their ability to work for more than one day. The main reasons for their inability to get to the workplace were transportation issues and communication breakdowns. In contrast, approximately 26% of participants asserted that their employment and income sources remained largely unaffected by the cyclone. The analysis shows that the cyclone affected the livelihoods of the majority of people, and it is uncertain to what extent the government's financial assistance compensated for wage losses. The management approach fails to address the restoration of economic activities, as it focuses only on reconstruction and relief measures.

One of the key components of cyclone resilience is economic restoration. This not only means supplying goods

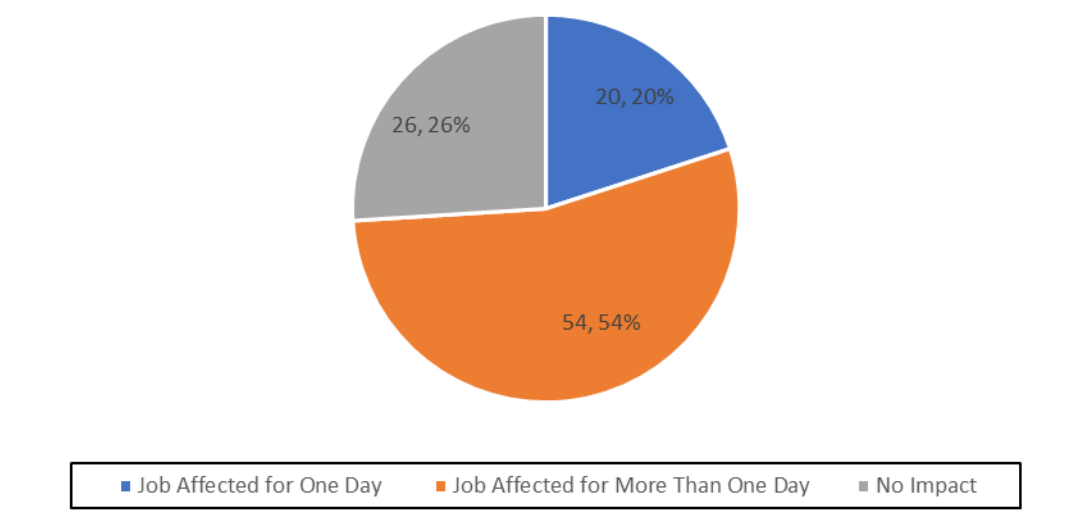


Fig. 5. Impact of cyclone on the jobs and livelihood of the residents.

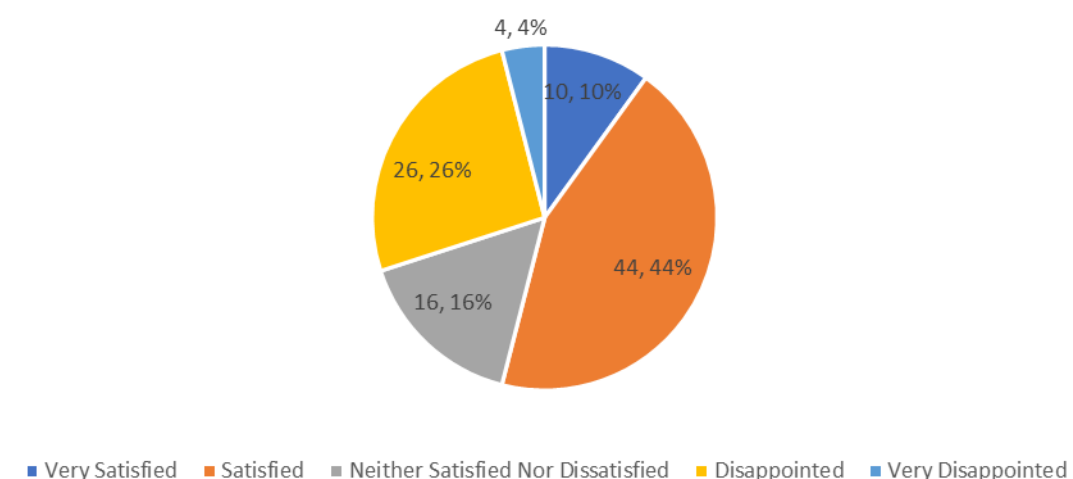


Fig. 6. People's response to the steps taken by the government to deal with the cyclone.

and services in the affected areas but also identifying and looking after vulnerable communities affected by the cyclone, such as fishermen, daily wagers, and hawkers. Their identification enables community actors to provide them with an alternative source of employment or gainful social engagement. This shortcoming of the management approach is addressed in terms of resilience through the active involvement of the community to ensure the restoration of economic life as soon as possible (UNDP, 2020).

The researchers documented a range of responses about the people's satisfaction with the administration's management of the cyclone. The responses are categorised into five parts: very satisfied, satisfied, neither satisfied nor dissatisfied, disappointed, and very disappointed, as shown in Fig. 6. Among the participants surveyed, only 10% stated that they were very satisfied with the government's approach to the emergency. In comparison, 44% expressed satisfaction with the approach. Around 16% of the respondents maintained a neutral stance on the government's approach, identifying as neither satisfied nor dissatisfied. Fur-

thermore, 26% of respondents expressed disappointment, and the remaining 4% voiced profound disappointment with the management plan and strategy of the Puducherry administration. The present cyclone management is based on a client-patron approach, in which citizens of Puducherry are on the receiving end and are treated as clients. The administration addresses their needs and hardship due to the cyclonic impact. This client-patron approach treats cyclone as an administrative responsibility that must be addressed by the administrative staff on every occasion, and the cyclone-led hardships are an additional burden in terms of deploying additional staff, disrupting regular work, and imposing a financial burden. This is a management cum contingent approach that repeats almost every few years.

5.1 Gap analysis: Policy and Operation

The data analysis and the government perspective highlight the reliance on the management approach. Pondicherry is highly vulnerable to cyclones and has been

affected by frequent cyclonic events over time. The 6th Assessment report of the Intergovernmental Panel on Climate Change projects a rising number of cyclones in the future, and even the Ministry of Earth Science's scientific study also states that the eastern coast of India is likely to witness more cyclones in the coming years (MoES, 2020; IPCC, 2023, p. 34). Cyclones, in past years, have not only claimed hundreds of lives but also damaged the material assets in Pondicherry. Even though there is an enduring threat from cyclones, the Pondicherry government's overall approach focused primarily on post-cyclone recovery. The overall disaster management strategy in India, as laid by the DMA 2005, underemphasises the need for building resilience and provides for management cum contingency approach, and Pondicherry government's cyclone management strategy is not different in any way. Apart from the early warning system, the rest of the focus is on post-recovery measures. In the case of Cyclone Fengal, the management-cum-contingency approach is clearly evident in the empirical observations in this research. The government, in response to Cyclone Fengal, took various preventive measures, such as activating the early warning mechanism, which alerted residents to the approaching cyclone. In addition, the district administration had shared emergency contact numbers and a list of shelter homes. However, most of it was non-functional. In the post-disaster response, the Union Territory government announced financial assistance of Rs. 5000 for every ration card holder. The government raised a demand of Rs. 614.88 crores from the central government and failed to engage the community in raising crowdfunding to boost the resources. The political-economic analysis of the data shows that post-recovery efforts were not uniform for all the regions. In some politically influential regions, recovery measures were implemented immediately, while other regions had to wait a few days. Overall, community participation was not called for, and the administration bore the entire onus of the cyclone response. Conversely, people acted passively and waited only for assistance from the government.

The respondents also highlighted some of the drawbacks and limitations of the government's cyclone management-cum-contingency policy. First, the government did not make much effort to ensure cyclone preparedness and awareness by learning from past experiences. Second, many respondents expressed dissatisfaction with the government's assistance after the cyclone, as it did not adequately address their losses and was delayed. Third, waterlogging emerged as one of the major problems faced by the people, highlighting loopholes in the district's drainage system.

Based on the empirical analysis of the management of Cyclone Fengal, the lack of community participation emerged as a major loophole in the UT's cyclone management strategy. Community engagement is essential to realise cyclone resilience in Puducherry. A blend of administrative and community engagement in cyclone response shall ensure adaptability based on past events, resourcefulness to meet pre- and post-cyclone financial and other requirements, absorption to absorb the shock generated by the cyclone, and rapidity to ensure a timely and comprehensive recovery from the cyclone. Apart from govern-

ment support, there was a lack of assistance from civil society organisations. The government needs to collaborate with non-governmental organisations to carry out post-recovery measures. As discussed earlier, Puducherry has a strong civil society presence, with members from India and abroad, including the Sri Aurobindo Society and the Auroville Foundation, which can be actively engaged in the cyclone response. In addition, Puducherry has a strong network of Temples, and members of the Covil (Temple) trusts can be engaged to sensitise and engage the community. There are several other Non-Governmental Organisations in Puducherry, such as the Lions Club and the Kuddle Life Foundation, which are active in many other fields but have a negligible presence in cyclone response efforts. Analysis of empirical data found that people were largely dependent on the government, even for minor tasks like clearing fallen trees or poles from roads. This rift between the administration and the community gives private players an opportunity to make their fortune from a natural crisis. Also, it promotes crony capitalism, in which disasters are seen as opportunities to generate financial gains. Given the significant impact of disasters on individuals and their everyday lives in contemporary society, it is crucial to promote greater community engagement in addressing cyclones and ensuring a transition from management-cum-contingency approach to cyclone resilience.

6 Conclusion

Cyclones have remained a major concern for India's coastal regions, particularly along the eastern coast, which is known for high-intensity, devastating cyclones. Puducherry, with a 25 km coastline at the Bay of Bengal, remains highly vulnerable to cyclones. Cyclone Fengal made landfall near Puducherry in November 2024, bringing unprecedented rainfall and strong winds. The empirical analysis shows a mixed scenario, highlighting the strengths and weaknesses of the pre- and post-disaster measures undertaken by the government. Cyclone Fengal highlighted a relatively strong and effective early warning system, a quick relief delivery mechanism, and swift post-disaster financial assistance. There were several gaps in service continuity, local-level engagement, livelihood recovery, and the low operational visibility of civil society's involvement. While the formal disaster management policy framework emphasises community participation, the survey suggests limited community involvement in planning and implementation. Even though the day-to-day lives of residents in Puducherry have frequently been disrupted by cyclonic activity and heavy rainfall, the district's drainage system remains inadequate, with waterlogging emerging as a major problem for people and disrupting transport facilities. The empirical analysis reveals weaknesses and gaps in the implementation of disaster management measures outlined in government plans. The traditional approach focuses heavily on post-disaster measures rather than on measures to develop cyclone resilience. Apart from this, cyclone resilience calls for resourcefulness, whereby locally accumulated resources meet most requirements. However, in the case of the Fengal, the UT government is highly dependent on the Centre for

fund allocation. Cyclone resilience has to be achieved in two broad ways: first, by creating a disaster-resilient community through adaptation, absorption, rapidity, and resourcefulness, with the active involvement of existing actors in civil society. Second, overall infrastructure resilience needs to be achieved by identifying vulnerable areas, infrastructure, and community assets so that the shock of the cyclone can be absorbed with minimal loss to existing infrastructure.

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Conflict of Interest

The authors declare no competing interest.

CRediT statement

Sanjay Sharma: Research outline, questionnaire design and analysis, writing. **Sunil Kumar:** Research background, methodology, policy analysis, writing. **Maneesh Kumar:** Data collection, data analysis, writing.

Ethical Statement

Data is collected from Puducherry, and the anonymity of the participants was maintained. In addition, data were collected only after informed consent from the participants.

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References

- Balachandran, K.K., Laluraj, C.M., Jyothibabu, R., Madhu, N.V., Muraleedharan, K.R., Vijay, J.G., Maheswaran, P.A., Ashraff, T.T.M., Nair, K.K.C., Achuthankutty, C.T., 2008. Hydrography and biogeochemistry of the northwestern Bay of Bengal and the north-eastern Arabian Sea during winter monsoon. *Journal of Marine Systems* 73, 76–86. <https://doi.org/10.1016/j.jmarsys.2007.09.002>.
- Boragapu, R., Guhathakurta, P., Sreejith, O.P., 2023. Tropical cyclone vulnerability assessment for India. *Natural Hazards* 117, 3123–3143. <https://doi.org/10.1007/s11069-023-05980-5>.
- Census, 2011. *Government of India*. <http://censusindia.gov.in>.
- Department of Science, Technology and Environment, 2013. *Vulnerability Analysis on Climate Change for U.T. of Puducherry. DST, India*. <https://dste.py.gov.in/PCCC/pdf/VA.pdf>.
- Desai, H., 2020-12-02. Only in 1963 did Puducherry become an integral part of India. *Asian Voice*. <https://www.asian-voice.com/Opinion/Columnists/Hari-Desai/Only-in-1963-Puducherry-became-integral-part-of-India>.
- Disaster Management Division, 2024. *Situation report regarding Cyclonic Storm FENGAL*. <https://ndmindia.mha.gov.in/ndmi/viewUploadedDocument?uid=NEW2257>.
- Dominique, B., 2023-12-04. Cyclone Michaung: Puducherry imposes orders prohibiting the movement of people along the coast. *The Times of India* <https://timesofindia.indiatimes.com/city/puducherry/cyclone-michaung-puducherry-imposes-orders-prohibiting-movement-of-people-along-coast/articleshow/105732342.cms>.
- Dutta, D., 2022-12-09. Cyclone Mandous wreaks havoc in Puducherry, and fifteen houses on the Pillaichavady coast collapse. *The New Indian Express* <https://www.newindianexpress.com/states/tamil-nadu/2022/Dec/09/cyclone-mandous-wrecks-havoc-in-puducherry-fifteen-houses-on-pillaichavady-coast-collapse-2526584.html>.
- Dutta, D., 2024. Puducherry was declared a natural calamity-affected area post Cyclone Fengal. *The New Indian Express* <https://www.newindianexpress.com/states/tamil-nadu/2024/Dec/06/puducherry-declared-as-natural-calamity-affected-area-2>.
- FC-XV, 2020. *Report of the Fifteenth Finance Commission*. <https://fincomindia.nic.in/commission-reports-fifteenth>.
- Global Assessment Report on Disaster Risk Reduction, 2015. *Making Development Sustainable: The Future of Disaster Risk Management*. <https://www.undrr.org/media/14914/download?startDownload=20250628>.
- Government of Puducherry, 2024. *Puducherry District Disaster Management Plan 2024*. <https://revenue.py.gov.in/downloads/dm/DDMP%20Vol-I%202024.pdf>.
- GSDMA, 2014. *Cyclone Preparedness and Response Plan*. <http://www.gsdma.org/uploads/Assets/other/cyclonepreparednessresponseplan06072017051948575.pdf>.
- Hindustan Times, 2024-11-30. Cyclone Fengal tracker: Puducherry asks residents to stay indoors, issues helplines; heavy rain lashes Tamil Nadu. *Hindustan Times* <https://www.hindustantimes.com/india-news/cyclone-fengal-tracker-puducherry-asks-residents-to-stay-indoors-issues-helplines-heavy-rain-lashes-tamil-nadu-101732934688947.html>.
- IPCC, 2023. *Sixth Assessment Report (AR6)*. IPCC. https://www.ipcc.ch/site/assets/uploads/2023/03/Doc5_Adopted_AR6_SYR_Longer_Report.pdf.
- Jain, M., 2020-12-01. Though Cyclone Nivar had a soft landing, floods hit coastal districts. *MONGABAY* <https://india.mongabay.com/2020/12/though-cyclone-nivar-had-a-soft-landing-floods-hit-coastal-districts/>.
- Jena, S.K., 2017. Management of post-landfall riverine flooding, in: Mohapatra, M., Bandyopadhyay, B.K., Rathore, L.S. (Eds.), *Tropical Cyclone Activity Over the North Indian Ocean*. Springer. https://doi.org/10.1007/978-3-319-40576-6_6.
- Kato, T., 2021. Sharing experience by residents of past disaster sites: Effects of time from disasters and types of experience. *International Journal of Disaster Risk Reduction* 61, 102390. <https://doi.org/10.1016/j.ijdrr.2021.102390>.
- Kovalevski, V., n.d. *Early Warning Systems*. Global Disaster Preparedness Center. Retrieved on June 29, 2025, from <https://preparecenter.org/topic/early-warning-systems/>.

- Kumar, K.J.A., Walia, A., Chaturvedi, S., 2012. *India Disaster Report 2011*. <https://nidm.gov.in/PDF/pubs/India%20Disaster%20Report%202011.pdf>.
- MoES, 2020. *Assessment of Climate Change over the Indian Region*. Ministry of Earth Sciences, Govt. of India.
- NDMA, 2008. *National Disaster Management Guidelines: Management of Cyclone*. NDMA, New Delhi. <https://ndma.gov.in/Natural-Hazards/Cyclone/Resources>.
- NDMA, 2015. *Environment and Social Management Framework*. <https://documents1.worldbank.org/curated/en/444611468252272079/pdf/E45560V10REVIS00Box385436B00PUBLIC0.pdf>.
- NIDM, 2021. *Mapping Climatic and Biological Disasters in India*. https://nidm.gov.in/PDF/pubs/GIZNIDM_21.pdf.
- Parsons, M., Glavac, S., Hastings, P., Marshall, G., McGregor, J., McNeill, J., Morley, P., Reeve, I., Stayner, R., 2016. Top-down assessment of disaster resilience: A conceptual framework using coping and adaptive capacities. *International Journal of Disaster Risk Reduction* 19, 1–11. <https://doi.org/10.1016/j.ijdr.2016.07.005>.
- Perier, B., 2024. Cyclone Fengal: Record rainfall inundates Puducherry, Villupuram. *The New Indian Express* <https://www.newindianexpress.com/states/tamil-nadu/2024/Dec/02/cyclone-fengal-record-rainfall-inundates-pondy-villupuram#:~:text=made%20food%20items.-,The%20heavy%20rainfall%20caused%20major%20waterbodies%20and%20canals%20to%20overflow,%2C%20Nellithope%2C%20and%20Kamaraj%20Salai>.
- PIB, 2025. *National Cyclone Mitigation Risk Project*. Government of India. <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2099536#:~:text=NCRMP>.
- PTI, 2020-11-26. Cyclone Nivar impact: Heavy rains batter Pondicherry, trees uprooted. *Press Trust of India*. <https://economictimes.indiatimes.com/news/politics-and-nation/cyclone-nivar-impact-heavy-rains-batter-pondicherry-trees-uprooted/articleshow/79421962.cms?from=mdr>.
- Punithavati, J., Tamilenth, S., Baskaran, R., 2012. A study of Thane cyclone and its impacts in Tamil Nadu, India, using geographic information system. *Archives of Applied Science Research* 4. <https://www.scholarsresearchlibrary.com/abstract/a-study-of-thane-cyclone-and-its-impacts-in-tamil-nadu-india-using-geographic-information-system-1535.html>.
- Ramesh, R., Bhatt, J.R., 2018. *Climate Change and the Vulnerable Indian Coast*. https://moef.gov.in/uploads/2019/10/Climate-Change-and-the-Vulnerable-Indian-Coast_compressed.pdf.
- Ranjan, R., Karmakar, S., 2024. Compound hazard mapping for tropical cyclone-induced concurrent wind and rainfall extremes over India. *Npj Natural Hazards* 1, 15. <https://doi.org/10.1038/s44304-024-00013-y>.
- Ray, M., 2020-11-24. Cyclone Nivar: Puducherry imposes prohibitory orders, allows shops selling essential goods to open. *Hindustan Times* <https://www.hindustantimes.com/india-news/cyclone-nivar-puducherry-imposes-prohibitory-orders-allows-shops-selling-essential-goods-to-open/story-fPa0ovJTxrHkHD13sTIpJ.html>.
- Roy, C., 2021-02-24. Explained: The trust vote in Puducherry. *The Indian Express* <https://indianexpress.com/article/explained/puducherry-congress-v-narayanasaamy-confidence-motion-kiran-bedi-7198641/>.
- Sarda, R., Bahadure, S., 2021. *Disaster Vulnerability Assessment: A Case Study of Puducherry*. EasyChair. <https://easychair.org/publications/preprint/wjsW/open>.
- Sethuram, B., 2024. *Strengthening Local Governance for Cyclonic Disaster Management: A Case Study of Puducherry District*. <https://ncgg.org.in/sites/default/files/lectures-document/Sethuram.pdf>.
- Sharma, S., 2022. Finance Commissions and Disaster Risk Funding: A Paradigm Shift in Methodology by Fifteenth Finance Commission. *Indian Journal of Public Administration* 69, 47–58. <https://doi.org/10.1177/00195561221109092>.
- Sri Aurobindo Society, 2024. *SARVAM's Cyclone Relief: Rebuilding Lives with Compassion*. Sri Aurobindo Society. <https://aurosociety.org/society/viewpastevents/1883/Past-Events>.
- Sundarapandian, S.M., Mageswaran, K., Gandhi, D.S., Dar, J.A., 2014. Impact of Thane Cyclone on tree damage in Pondicherry University campus, Puducherry, India. *Current World Environment* 9. <https://doi.org/10.12944/CWE.9.2.09>.
- Survey of India, 2024. *Length of Coastline of India*. <https://surveyofindia.gov.in/webroot/UserFiles/files/Length%20of%20Coastline%20of%20India.pdf>.
- The New Indian Express, 2022-12-11. Cyclonic storm “Mandous” causes havoc in Tamil Nadu, Puducherry. *The New Indian Express* <https://www.newindianexpress.com/galleries/nation/2022/Dec/09/in-photos-cyclonic-storm-mandous-causes-havoc-in-tamil-nadu-puducherry-103412.html>.
- TISS, 2005. *The State and Civil Society in Disaster Response: An Analysis of the Tamil Nadu Tsunami Experience*. TISS, India. <https://tnsdma.tn.gov.in/app/webroot/img/document/library/65-The-State-and-Civil-Society-in-Disaster-Response.pdf>.
- UNDP, 2020. *Guidelines for Community Participation in Disaster Recovery*. <https://www.gfdrr.org/sites/default/files/Guidelines%20for%20Community%20Participation%20in%20Disaster%20Recovery.pdf>.
- Wang, L., Shenghui, C., Yuanzheng, L., Hongjie, H., Bikram, M., Vilas, N., Xuejuan, F., Wei, H., 2022. A review of the flood management: from flood control to flood resilience. *Helvion* 8. <https://doi.org/10.1016/j.helivon.2022.e11763>.
- WMO, n.d. *Early Warning System*. World Meteorological Organization. Retrieved on June 29, 2025, from <https://wmo.int/topics/early-warning-system>.
- World Bank, 2021. *Tamil Nadu and Puducherry Coastal Disaster Risk Reduction Project*. <http://documents.worldbank.org/curated/en/256091638847065528>.