

ASSESSING CLIMATIC VULNERABILITY AND ITS EFFECTS ON COASTAL RURAL COMMUNITIES:

A STUDY CONDUCTED IN GANJAM DISTRICT, ODISHA

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ABSTRACT

India has a coastline stretching around 7,516 km, of which approximately 5,400 km lies along the mainland. Thirteen coastal states and Union Territories (UTs) in the country are exposed to various climatic vulnerabilities. Among them, four states—Tamil Nadu, Andhra Pradesh, Odisha, and West Bengal—are particularly prone to severe cyclones. The Bay of Bengal is known as one of the most cyclone-prone regions in the world. Odisha stands out as one of India's most climate-vulnerable states. Recurrent natural disasters significantly disrupt livelihoods and reduce the income levels of its people. Poor communities, largely dependent on climate-sensitive sectors such as agriculture, forestry, and fisheries, have limited capacity to adapt to the negative impacts of climate change. These adverse effects often lead to the loss of lives, livelihoods, assets, and infrastructure.

Index terms: Climate, vulnerability, coastal region, cyclone, livelihood

NEED OF THE STUDY:

This paper seeks to explore the real-life hardships faced by villagers in the coastal areas of Ganjam District, Odisha—communities that repeatedly bear the brunt of climatic adversity particularly frequently occurring cyclones. These residents adversely endure severe livelihood losses, including acute shortages of food, drinking water, and fuel, as well as detrimental impacts on health, education, and infrastructure. Among them, traditional marine fishermen are the worst affected.

1. INTRODUCTION

The eastern coastline along the Bay of Bengal, extending nearly 480 kilometres, is among the most environmentally sensitive coastal regions in India and is frequently exposed to climate-related hazards such as cyclones, storm surges, and coastal erosion. A substantial proportion of cyclones that develop along India's eastern seaboard strike the coast of Odisha, thereby increasing the region's exposure to climatic extremes. Even slight variations in oceanic conditions can trigger immediate and severe consequences for this fragile coastal environment. These risks are further amplified by ongoing global climate change, particularly rising sea levels, which intensify the frequency and severity of extreme weather events such as powerful waves, storm surges, and associated flooding. Over recent decades, global sea levels have been increasing at an estimated rate of 1.0 to 2.5 mm annually. The Bay of Bengal experiences intense monsoonal activity, accompanied by heavy rainfall during both monsoon and winter seasons, while severe cyclonic storms typically occur during the pre-monsoon and post-monsoon periods. Over the past two decades, Odisha has faced pronounced climatic variability, marked by alternating episodes of heatwaves, cyclones, droughts, and floods. With the continued progression of global warming and greenhouse gas accumulation, the coastal districts of Odisha are expected to encounter more frequent and intense cyclonic disturbances in the future.

1.1: State of Odisha: At a Glance

Odisha, one of the 29 states of India, is situated along the eastern coast of the country. It shares its borders with West Bengal to the northeast, Jharkhand to the north, Chhattisgarh to the west and northwest, and Andhra Pradesh to the south and southwest. To its east lies the Bay of Bengal, along which the state extends for about 480 kilometres (301 miles), from Balasore in the north to Malkangiri in the south. Geographically, Odisha is located between latitudes 17.78°N and 22.73°N and longitudes 81.37°E and 87.53°E. The state covers an area of 155,707 square kilometres, accounting for approximately 4.87% of India's total land area. The coastal plain occupies the eastern part of the state. Odisha ranks as the ninth-largest state in India by area and the eleventh by population, which, according to the 2011 Census of India, stands at 41,947,358.

General Information on Odisha Coast:

- Key Coastal Features of Odisha

- **Coastline Length:** Approximately 480 km
- **Major Estuaries:** Six
- **Coastal Districts:** Six
- **Coastal Population:** About 36% of the total population and 43% of the urban population
- **Fisherfolk Population (Coastal):** 1,73,197
- **Estimated Fishing Potential:** 2,08,000 tonnes per year
- **Climate Type:** Moist sub-humid to dry sub-humid
- **Average Annual Rainfall:** 1,100–1,500 mm
- **Ports:** One major port and one minor port
- **Fishing Harbours:** One major and three minor
- **Tidal Regime:** Micro- to meso-tidal

1.2: Climatic Vulnerability and Odisha

Vulnerability refers to the degree to which a population or system is susceptible to harm when exposed to climatic hazards, influenced by both environmental and socio-economic conditions. Odisha is regarded as one of the most climate-vulnerable states in India due to persistent poverty, limited adaptive capacity, and the frequent occurrence of cyclones and floods. A significant share of cyclones forming along India's eastern coastline make landfall in Odisha, largely because of its geographical position along the northern Bay of Bengal. The state's 480-kilometre-long coastline encompasses six coastal districts—Balasore, Bhadrak, Kendrapada, Jagatsinghpur, Puri, and Ganjam—which remain highly sensitive to cyclonic disturbances. Even minor changes in sea conditions can result in widespread damage across these areas. During the last two decades, Odisha has experienced repeated extreme weather events, ranging from heatwaves and droughts to cyclones and floods. The gradual rise in sea levels has further increased the exposure of coastal ecosystems and human settlements, intensifying the overall climatic vulnerability of the region.

Climate change has had significant consequences for both society and the environment, with natural calamities severely impacting livelihoods and reducing income levels across Odisha. Among the six coastal districts, Ganjam is one of the most vulnerable and frequently experiences natural disasters such as droughts, and cyclones. The major flood of 1990, the Super Cyclone of 1999, and Cyclone Phailin in 2013, Titli in 2018, Fani in 2019 have repeatedly disrupted the district's economy and weakened its resilience. Cyclonic events, in particular, have caused a range of direct impacts that threaten livelihoods, including high tides, flooding, saltwater intrusion, and prolonged waterlogging.

In response to the devastation caused by the 1999 Super Cyclone, the state government implemented several mitigation measures—such as establishing modern communication networks, constructing cyclone shelters, and developing improved infrastructure, including permanent housing for economically weaker communities in cyclone-prone areas—to reduce the physical vulnerability of the coastal districts. Despite these efforts, several factors continue to heighten Odisha's exposure to cyclones: poor socio-economic conditions, fragile housing, dense settlements (including populated coastal islands) in areas susceptible to tidal surges, depletion of mangroves and shelterbelt vegetation, the presence of hazardous industries in cyclone-prone zones, and inadequate road connectivity to coastal villages.

2. STUDY AREA AND METHODS

The present study seeks to understand the actual hardships faced by villagers residing in the coastal regions of Ganjam District, Odisha, who are repeatedly subjected to the adverse impacts of climatic vulnerability. These communities endure significant losses in their livelihoods, ranging from acute shortages of food, drinking water, and fuel to serious effects on health, education, and local infrastructure. Among them, the traditional marine fishing communities along the Ganjam coast—particularly those in the Gopalpur area—are the most severely affected.

The study employs a combination of household surveys and Focus Group Discussions (FGDs) to examine the socio-economic consequences of climate change on these communities. Data were collected from two coastal villages, Podampeta and Karapalli, located in the Gopalpur-on-Sea belt. The FGDs were conducted in the local Odia language, focusing primarily on the perceived and observed effects of climate change on livelihoods. Since most residents in these villages depend on both agriculture and fishing for their sustenance, the study purposively selected households engaged in both occupations. In total, 50 households were surveyed—25 from Podampeta and 25 from Karapalli.

3. FINDINGS

After discussing with the villagers, the various responses regarding the effect of climatic vulnerability on their lives, the findings are:

3.1 Effects of Regular Climatic Change:

3.1.1 Effect on Occupation:

Fishing during cyclonic weather conditions becomes extremely hazardous. Climate change-induced depressions and cyclones not only disrupt fishing activities but also hinder the drying and preservation of fish. During heavy rainfall, fish tend to remain in deeper waters, making it difficult for fishermen to achieve a good catch even when they venture out at great risk. Strong winds and turbulent sea conditions often cause boats to capsize, forcing fishermen to swim across the sea to survive—a task they describe as arduous and life-threatening due to powerful sea currents. In such situations, injuries are common, either from collisions during capsizing or from entanglement with boat propellers. Tragically, several deaths have been reported due to drowning or propeller-related injuries.

3.1.2 Effect on Agriculture

Agriculture in these two villages is highly vulnerable to multiple hazards, including cyclones, tidal surges, and droughts. While these events rarely pose an immediate threat to human life, they severely affect the economic stability of individual farming households. Farmers invest substantial amounts of money each season with the expectation of a good harvest; however, a single cyclone or flood can destroy crops entirely, leading to significant financial losses and increased indebtedness.

3.1.3 Effect on Housing

Housing represents one of the most valuable assets for residents of both villages. Most households own their homes; however, many dwellings in the fishing village are not *pucca* (permanent) structures—meaning they lack brick walls or concrete roofs. These semi-permanent houses are particularly vulnerable to damage during floods and cyclones, events that occur with alarming regularity in the region. Consequently, recurrent structural damage poses a continuous economic burden on the affected families.

3.2: Effects of last cyclone on the villagers

The cyclone caused extensive destruction in the coastal villages.

- Numerous old and large trees, including those that provided vital livelihood support to thousands of people, were uprooted.
- Most thatched houses suffered severe damage, while several asbestos-roofed houses also had their roofs partially or completely blown away.
- Children were among the worst affected, as their clothing, school materials, and other essentials were destroyed.
- The continuous rainfall that followed the cyclone further aggravated the situation, worsening living conditions and hampering relief efforts.
- The cyclone resulted in widespread loss of property and livelihood assets in the affected villages.
- Most households lost their essential belongings, including cooking utensils, bedding, and clothing.
- Power supply was completely disrupted, and due to the unavailability of kerosene and candles, residents were left in darkness for several days.
- Access to safe drinking water also became a major challenge.
- In Podampeta village, 12 houses were submerged by the advancing sea, directly affecting around 140 fisherfolk.
- Additionally, approximately 150 fishing nets were lost and 50 boats sustained severe damage.
- Agricultural activities in the region were equally disrupted, as fields were inundated and crops destroyed.
- The majority of fishing boats were rendered non-functional, and nearly all fishing nets were damaged.
- The village livestock also suffered significant losses, further aggravating the economic hardship faced by the community.

CONCLUSION

The recurring occurrence of floods and cyclones resulting from climate change has rendered the rural population in the study area highly vulnerable. Communities with limited economic means possess low adaptive capacities to cope with these adverse impacts, largely due to their heavy dependence on climate-sensitive sectors such as agriculture and fisheries. Their vulnerability is further exacerbated by inadequate infrastructure, weak institutional support systems, and a lack of financial resources. The direct consequences of climatic variability include the loss of lives, livelihoods, assets, and infrastructure. To mitigate these impacts, it is imperative to establish an integrated system that enhances preparedness and resilience at all levels—governmental, institutional, and community.

FUTURE IMPLICATIONS

Further research can be conducted on the possible ways to reduce the vulnerability.

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