

RESEARCH PAPER**OPEN ACCESS****Typhoon risk perception and preparedness after Sendong in Bayug Island**

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ABSTRACT

This study examines how residents of Bayug Island interpret typhoon-related environmental risk after tropical storm Sendong and how this perception shapes household and community preparedness. Drawing from a focus group discussion with eleven residents and supporting key informant interviews, the study used an interpretive qualitative design to analyze lived disaster experience, coastal and flood exposure, local warning systems, livelihood dependence, and household mobility. Findings show that Sendong recalibrated residents' environmental risk perception by transforming familiar signs such as rainfall, river rise, and warnings into more immediate signals of danger. Preparedness became practical, anticipatory, and evacuation-oriented through go-bags, warning monitoring, trusted local leadership, household protective actions, and agreed evacuation points. However, preparedness remained uneven because poverty, livelihood assets, caregiving duties, fear of theft, mobility limits, and structural constraints shaped residents' capacity to act. The study concludes that disaster preparedness in coastal communities is a human-environment process shaped by environmental exposure, memory, local communication, and socioeconomic conditions.

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INTRODUCTION

Coastal and flood-exposed communities are among the most vulnerable to hydro-meteorological hazards because their location places them near dynamic environmental systems such as rivers, shorelines, storm surge pathways, and low-lying floodplains. Globally, millions of people experience coastal flooding each year due to storms and typhoons, while climate change continues to intensify risks in communities already exposed to flooding, coastal erosion, storm surge, and land scour (Ali *et al.*, 2022; Kesavan and Swaminathan, 2006). In the Philippines, these risks are especially important because the country regularly experiences typhoons and other hazards that affect both the physical environment and the social conditions of vulnerable communities.

Disaster Risk Reduction and Management often emphasize technical measures such as hazard mapping, early warning systems, infrastructure improvement, and physical mitigation. These measures are necessary, but they do not fully explain how people living in high-risk environments understand danger and act on preparedness. Risk perception is important because people do not respond to hazards only through scientific information or official warnings; they also interpret danger through memory, local observation, livelihood needs, household responsibilities, and previous disaster experience (Dhar *et al.*, 2023). Thus, preparedness in exposed coastal communities should be understood not only as a technical issue, but also as a human-environment process shaped by both physical exposure and lived realities.

Bayug Island in Iligan City provides a relevant case for examining this relationship. The community is exposed to typhoon-related hazards such as riverine flooding, storm surge, coastal erosion, and strong winds. These environmental hazards intersect with socioeconomic conditions such as livelihood dependence, limited infrastructure, uneven access to information, and household caregiving responsibilities. Tropical Storm Sendong, internationally known as Washi, became a major turning point in Iligan City, bringing severe flooding, loss of lives, destruction of homes, and

environmental disruption in vulnerable communities such as Bayug Island (Office of Civil Defense-Regional Disaster Risk Reduction and Management Council Region X, 2012; PeaceBuilders Community, 2012). Since then, Sendong has remained a reference point for how residents understand typhoon-related danger and preparedness.

This study examines how current typhoon-risk perception and preparedness in Bayug Island are shaped by lived disaster experience, environmental exposure, and household-community conditions. Rather than treating preparedness as awareness alone, the study analyzes how residents interpret warnings, environmental cues, local communication, evacuation needs, livelihood concerns, and structural limitations. In doing so, it contributes to environmental risk research by showing how disaster preparedness in a coastal community emerges from the interaction between hazard exposure, community memory, and practical capacity to act.

Additionally, this study contributes to environmental science by showing how residents' preparedness practices are shaped by the interaction of hazard exposure, coastal settlement conditions, livelihood dependence, and local environmental cues.

MATERIALS AND METHODS

Research design and study site

This study used an interpretive qualitative design. Bayug Island was treated as a human-environment setting where physical exposure and social vulnerability intersect. The study focused on how residents understand typhoon-related hazards and how these meanings are connected to household and community preparedness. It did not seek to model hazard intensity or statistically measure risk perception. Instead, it examined how residents narrated present danger and how those meanings were connected to practical action.

Bayug Island was selected because of its exposure to typhoon-related hazards and its historical experience of severe disaster during Tropical Storm Sendong. The

community's location near riverine and coastal systems makes it relevant for examining how residents interpret environmental cues such as rising water, bridge conditions, river levels, flood experience, and the absence or presence of safe spaces. The site is therefore understood not only as a physical location, but as a lived environment where hazard exposure, household memory, livelihood, and community relations intersect.

Data sources and participants

The analysis was primarily based on a focus group discussion with eleven residents of Bayug Island who had lived in the area before and after Sendong. The discussion was conducted in Bisaya, the local language of the participants. Supporting key informant interviews were also conducted with four former or knowledgeable residents to provide contextual depth, especially regarding household experiences, warning interpretation, relocation, and preparedness after Sendong.

Participant identities were anonymized. Focus group participants were labeled as P1, P2, and so on, while key informants were labeled as KI1, KI2, and so on. This protected confidentiality while allowing the analysis to remain grounded in participant accounts.

Data analysis

The analysis followed an iterative qualitative process. Transcript excerpts were reviewed for recurring meanings related to environmental risk perception, warning response, household preparedness, community preparedness, and constraints on action. Initial codes were clustered into broader patterns and then refined into themes.

The analysis moved between individual accounts and the overall pattern of the data. Particular statements, such as preparing a go-bag, evacuating once the purok president sends a message, observing river warning levels, or delaying movement because of livelihood concerns, were interpreted in relation to the broader issue of preparedness in an environmentally exposed community. Key vernacular terms were retained where

they carried important meaning, especially when they reflected local understandings of warning, caution, livelihood, and learned disaster experience. This interpretive movement was informed by hermeneutic phenomenology, where meaning is understood as historically situated and dialogical (Gadamer, 2004; Schmidt, 2006).

Ethical considerations

The study followed ethical principles for research involving human participants, including informed consent, voluntary participation, confidentiality, and respect for participants who discussed disaster-related experiences. Participants were informed of the purpose of the study and their right to decline any question or withdraw from participation. Identifying details were removed from the analysis, and participant labels were used in place of names.

Because the topic involved memories of Tropical Storm Sendong and later hazard experiences, the data collection was handled with care. The analysis used grouped and anonymized accounts, and the findings were written to protect participant identity while preserving the environmental and community meanings of their narratives.

RESULTS

Five themes emerged from the analysis: past typhoon impacts reshaped environmental risk perception; local warning systems strengthened response to environmental cues; household preparedness became anticipatory and evacuation-oriented; environmental exposure and socioeconomic constraints limited preparedness; and community-level adaptation remained constrained by structural conditions. Table 1 presents selected local terms that carried analytic meaning, while Table 2 shows how evidence was interpreted in relation to perceived risk and preparedness response.

Past typhoon impacts reshaped environmental risk perception

Residents' current perception of typhoon-related danger is strongly shaped by what they experienced

during and after Sendong. These experiences did not simply make them more aware in a general sense. They changed what danger now means in practical and emotional terms. Several participants explained that they now listen more closely to warnings, move earlier, and no longer rely on the confidence that characterized earlier responses to ordinary flooding.

The strongest accounts were grounded in hardship and survival. Participants remembered hunger, unsafe water, missing persons, logs carried by floodwater, near-death experiences, and the difficulty of surviving after the event. These memories suggest that current risk perception is not abstractly post-disaster. It is concretely shaped by what residents now know can happen when conditions worsen

quickly. Sendong widened the range of possible danger in residents' imagination.

Local warning systems strengthened response to environmental cues

Current evacuation behavior is strongly shaped by trusted local communication. Participants repeatedly identified the purok president as the most immediate and reliable trigger for action.

Once the purok president calls or sends a text, many residents leave right away or begin packing.

This indicates that formal warnings become more actionable when they are translated into concrete instruction by someone known and trusted within the community.

Table 1. Selected local terms relevant to current risk perception and preparedness

Bisaya term or expression	English translation	Contextual meaning
Maminaw	To listen	Paying close attention to news, warnings, and advice after Sendong.
Dili na pakumpyansa	No longer taking the risk lightly	Loss of earlier confidence that danger could be managed by familiarity.
Purok president	Neighborhood leader	Immediate local leader whose instructions are trusted during hazard events.
Panginabuhi	Livelihood	Fishing, livestock, stores, and other sources of income that may delay evacuation.
Natagam	Learned a hard lesson	Being deeply shaped by the experience of Sendong.
Danger zone	Danger zone	Official classification affecting services and residents' sense of safety.

Note. Local terms were retained where they carried analytic meaning in residents' accounts.

Table 2. Joint display of current risk perceptions and preparedness practices

Illustrative evidence	Perceived risk or hazard cue	Preparedness response	Interpretation
"Automatic nami na muhawa karon." (P3)	Warning already treated as serious	Immediate evacuation	Sendong recalibrated the urgency of movement.
"Pag naa na sa orange... pag naa na sa red warning, wala najud mi ana." (P6)	River color-coding signals danger	Contact at orange; leave at red	Warning interpretation combines formal and local cues.
"Mag andam nami ug flashlight, go-bag, medicine." (P1)	Incoming typhoon forecast	Emergency supplies prepared	Preparedness has become anticipatory and material.
"Among panginabuhi maam, naa diri." (P5)	Livelihood remains tied to place	Evacuation may be delayed	Socioeconomic conditions shape capacity to act.
"Wala mi maingon na safe diri sa Bayug." (P1)	Bayug perceived as spatially unsafe	Leaving becomes central to safety	Risk perception includes the sense that safety lies outside the community.

Note. Participant labels refer to anonymized focus group discussion participants.

Official messages and informal social communication now work together. Some participants described relaying text warnings to neighbors near the seashore and river. Others referred to river color-coding, where orange prompts contact and red means there is no

more waiting. Warning response therefore operates through a practical trust hierarchy, where institutional information gains force through local leadership, neighbor communication, and visible environmental cues.

Household preparedness became anticipatory and evacuation-oriented

Preparedness in Bayug has become more practical and anticipatory. Participants described preparing flashlights, medicine, biscuits, towels, and go-bags. Others described moving belongings to higher places, placing stones on roofs to reduce wind damage, contacting barangay transport in advance, and transferring temporarily to a safer household when typhoon news appears. These practices show that preparedness is not merely an attitude. It is expressed through material routines and early decisions.

Preparedness is also increasingly evacuation-centered. Some participants identified the evacuation center in Hinaplanon as the agreed family reunification point. Even when phone signal fails, the fallback plan is to meet physically at the evacuation center. This suggests that current preparedness is organized around leaving first and reuniting later, rather than waiting for all household members before acting.

Environmental exposure and socioeconomic constraints limited preparedness

Although current risk perception is sharper, early evacuation remains constrained by household realities. Participants explained that someone may stay behind because of belongings, livestock, fishing equipment, or sari-sari store goods that could be stolen if left unattended. These accounts show that residents are not simply choosing between safety and danger. They are weighing hazard risk against the possible loss of the material basis of household survival.

Care responsibilities and financial limitations also complicate evacuation. Participants described the difficulty of moving persons with disabilities, bedridden relatives, and older adults. Others noted that it is difficult to buy supplies or improve the house when daily needs and children's schooling already consume household resources. This means that increased awareness does not automatically produce strong preparedness. Residents may know what

should be done, but still lack the money, mobility, or security to do it fully.

Community-level adaptation remained structurally constrained

Preparedness in Bayug is not only household-based. Participants described river and coastal cleanup as a regular community practice intended to reduce blockage and lessen the return of garbage during flooding. They also referred to evacuation coordination, barangay service vehicles, and purok meetings where family meeting points and evacuation practices are discussed. These practices show that preparedness has become increasingly collective.

However, collective initiative operates within structural limits. Participants discussed the effects of danger zone status, service restrictions, lack of legal electricity, stolen solar lights, and stalled infrastructure. These conditions affect what residents can realistically do, even when they are organized and willing to prepare. Preparedness in Bayug is therefore both a community effort and a structural struggle.

DISCUSSION

The findings show that typhoon-risk perception in Bayug Island is shaped by the interaction of past disaster experience, present environmental exposure, and household capacity to respond.

Residents do not interpret typhoon-related hazards only through official warnings or technical hazard information. They also read risk through visible environmental cues, such as rising river levels, river color-coding, bridge conditions, coastal exposure, and the remembered physical impacts of Tropical Storm Sendong. This suggests that preparedness in hazard-prone communities is not only a behavioral response. It is also an adaptive practice shaped by the local environment and by the social conditions that either support or limit action.

Environmental risk perception after Sendong

The experience of Sendong changed how residents interpret environmental danger. Before a major

disaster, familiar flooding may be treated as manageable because people have lived with it repeatedly. After Sendong, however, the same environmental signs no longer carry the same meaning. Rainfall, river changes, warnings, and neighbor movement are now interpreted through the memory of severe flooding, hunger, unsafe water, missing persons, logs, and near-death experiences. In this sense, Sendong recalibrated local environmental risk perception (Dhar *et al.*, 2023).

This finding is important because risk perception in coastal and flood-exposed areas is not formed by hazard information alone. It is formed through lived contact with environmental disruption. Residents learned not only that typhoons can be dangerous, but that familiar surroundings can quickly become unsafe (Ali *et al.*, 2022). Bayug Island is therefore understood by residents not merely as home, but also as a space where safety can change rapidly during typhoon-related events.

Local warning systems and environmental cues

The findings also show that residents respond to typhoon risk through a combination of official warnings, local leadership, neighbor communication, and visible environmental markers. Formal advisories are important, but they become more actionable when reinforced by trusted local actors such as the purok president. This finding supports previous work showing that trusted community leadership and local social networks improve the effectiveness of disaster risk communication and encourage protective action during hazard events (Bonfanti *et al.*, 2023). The purok president does not simply transmit information.

This local leader helps convert warning into movement by giving residents a trusted signal that evacuation should begin.

Environmental cues also remain central to preparedness. River color-coding, rising water, bridge conditions, and the movement of nearby households help residents assess whether danger is becoming immediate. This shows that local

preparedness systems are partly formal and partly experiential. Residents combine official information with what they observe in their physical surroundings. For coastal and flood-prone communities, this combination is important because risk is often interpreted through both institutional messages and local environmental signs (United Nations Office for Disaster Risk Reduction, 2019).

Household preparedness as adaptive environmental practice

Preparedness in Bayug Island has become more practical, anticipatory, and evacuation-oriented.

Residents described preparing go-bags, flashlights, medicine, food, towels, important items, and other emergency supplies. They also described moving belongings to higher places, reinforcing parts of the house, contacting barangay transport, and identifying evacuation centers as family meeting points. These practices show that preparedness is not merely an attitude. It is expressed through material routines and early decisions.

These household actions can be understood as adaptive responses to repeated hazard exposure (Dhar *et al.*, 2023; Ali *et al.*, 2022). They do not remove the risk, but they help residents reduce possible harm when typhoon-related hazards intensify. The emphasis on evacuation also suggests that many residents no longer see staying in Bayug during severe conditions as the safest option. Preparedness has therefore shifted from simply enduring the hazard to leaving early (United Nations Office for Disaster Risk Reduction, 2019), regrouping in safer places, and protecting essential belongings where possible.

Environmental exposure and socioeconomic limits

Although risk perception has become sharper after Sendong, preparedness remains uneven because households do not have the same capacity to act. Residents may know that evacuation is necessary, but livelihood, poverty, caregiving responsibilities, mobility limitations, and fear of theft can delay movement.

Fishing equipment, livestock, sari-sari store goods, and household belongings are not minor concerns. For many households, these are connected to survival after the hazard has passed.

This shows that environmental risk cannot be separated from socioeconomic conditions. A household's ability to respond depends not only on whether residents recognize danger, but also on whether they have money, transport, physical mobility, support for older adults or persons with disabilities, and a secure place for belongings and livelihood assets. In this sense, vulnerability in Bayug Island is both environmental and social (Ali *et al.*, 2022). Residents live with physical exposure to typhoon-related hazards, but their ability to prepare is also shaped by the resources available to them (Kesavan and Swaminathan, 2006).

Community preparedness and structural constraints

Preparedness in Bayug Island is not only household-based. Participants described river and coastal cleanup activities, barangay transport, purok meetings, neighbor-to-neighbor warning, and agreed evacuation points. These practices show that the community has developed shared responses to typhoon-related environmental hazards (United Nations Office for Disaster Risk Reduction, 2019).

However, community initiative operates within structural limits. Participants' accounts of danger zone status, service restrictions, lack of legal electricity, stolen solar lights, and stalled infrastructure show that local action cannot fully compensate for wider institutional and infrastructural gaps. Cleanup drives and warning relays are valuable, but they cannot replace safe infrastructure, reliable services, livelihood-sensitive planning, and clear support for residents living in hazard-prone areas. This means that community resilience should not be romanticized.

Bayug residents have learned, adjusted, and organized, but their preparedness still depends on

systems beyond the household and purok level. Similar observations have been reported in disaster risk reduction research, where institutional trust and collaboration are essential for sustaining long-term community resilience (Bonfanti *et al.*, 2023).

Implications for environmental risk management

The findings have several implications for environmental risk management in coastal and flood-exposed communities.

First, risk communication should integrate official warnings with trusted local communication channels (United Nations Office for Disaster Risk Reduction, 2019; Bonfanti *et al.*, 2023). Warnings may be more effective when they are translated into clear local instructions through barangay leaders, purok leaders, and neighborhood networks.

Second, household preparedness should consider material capacity. Teaching residents to prepare go-bags is important, but poor households may need support in obtaining basic emergency supplies, safe storage, and transport during evacuation.

Third, evacuation planning should account for households with older adults, persons with disabilities, bedridden family members, children, and livelihood assets. Preparedness plans that assume all households can move quickly may overlook the residents who face the greatest difficulty during evacuation.

Fourth, community-level preparedness should be supported by structural interventions (Ali *et al.*, 2022). Local cleanup, warning relays, and coordinated evacuation are important, but they should be matched with infrastructure, services, safer routes, livelihood-sensitive support, and clear policies for residents in danger zones.

Overall, the study shows that typhoon preparedness in Bayug Island is a human-environment process. Residents respond not only based on what they know

about hazards, but also based on what their physical environment, household conditions, livelihood realities, and institutional support allow them to do.

Study limitations

The study is context-bound to Bayug Island and is not intended for statistical generalization to all coastal or flood-exposed communities. The findings are based on qualitative accounts from a focus group discussion and supporting key informant interviews, so the interpretation reflects the experiences and meanings shared by the participants rather than population-level measurement.

The study also did not conduct hydrodynamic, engineering, or predictive hazard modeling.

References to flood, river, coastal, and danger zone conditions were used descriptively to situate residents' accounts within their environmental setting. Future studies may combine qualitative accounts with spatial exposure data, household preparedness indicators, and local disaster risk reduction planning documents to further deepen understanding of environmental risk and preparedness.

CONCLUSION

This study shows that typhoon-risk perception and preparedness in Bayug Island are shaped by lived disaster experience, environmental exposure, local communication, household vulnerability, and structural conditions. Tropical Storm Sendong changed how residents interpret danger, making warnings and environmental cues more immediate and actionable. Preparedness has become practical, anticipatory, and evacuation-oriented, but remains uneven because poverty, livelihood dependence, caregiving responsibilities, fear of theft, mobility limits, and limited infrastructure shape residents' capacity to respond. Disaster preparedness in coastal communities must therefore be understood not only through what people know, but also through what their environmental and socioeconomic conditions allow them to do.

RECOMMENDATION(S)

Local Disaster Risk Reduction and Management programs should integrate official warnings with trusted local communication channels, especially purok leaders, barangay relays, and neighbor-to-neighbor networks.

Household preparedness programs should include material support for vulnerable households, including basic emergency supplies, safe storage strategies, transportation support, and livelihood-sensitive evacuation planning.

Evacuation planning should give particular attention to households with older adults, persons with disabilities, bedridden family members, children, and livelihood assets, since these conditions affect the speed and safety of movement.

Future research may combine qualitative accounts with spatial exposure data, household preparedness indicators, and local planning documents to better understand environmental risk and community preparedness in coastal settlements.

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