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EMPOWERING CHILDREN FOR PARTICIPATORY DISASTER MITIGATION: A DEVELOPMENT COMMUNICATION APPROACH IN KUBU RAYA, WEST KALIMANTAN

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ABSTRACT

Kubu Raya Regency in West Kalimantan is a region with a high level of disaster risk. Based on the 2022 Indonesian Disaster Risk Index (IRBI), Kubu Raya is categorized as high risk due to its geographic conditions, which are dominated by lowlands, swamps, and large rivers. Despite various mitigation programs, children's involvement in these processes remains minimal, even though they have the potential to be agents of change in their communities. This study aims to identify forms of participatory communication for children in disaster mitigation. This approach is based on the view that development communication not only conveys information but also empowers communities through active participation, including children's communities. The research used a qualitative Participatory Action Research (PAR) approach, grounded in the Risk Communication Theory of Covello & Sandman. The study involved 16 children from the Ambawang Kubu Raya Forum Anak community. They were involved in flood risk mapping activities, evacuation simulations, and the production of community-based disaster campaign media. The study was conducted in July 2025. This study concluded that participatory communication is effective in helping children identify flood hazards based on their experiences

and observations. Through the Child-Friendly Participatory Geographic Information Systems approach, children not only visually mapped risks but also strengthened their spatial awareness and engagement in building community resilience. Furthermore, they articulated an ideal, healthy, safe, inclusive environment and expressed their desire to participate in mitigation actions actively. These findings demonstrate that a development communication approach that involves children directly strengthens communities' adaptive capacity in disaster-prone areas.

INTRODUCTION

Global climate change has emerged as a significant factor behind the increasing disaster risks across vulnerable regions in Indonesia. Inequitable spatial planning and development practices that overlook ecologically fragile areas further intensify these risks. Kubu Raya Regency in West Kalimantan illustrates this condition, as its low-lying terrain, characterized by swamp ecosystems and major river systems, makes the region highly susceptible to recurrent flooding. (Djalante et al., 2017). Disparities in infrastructure between central and peripheral regions, coupled with spatial governance that lacks climate sensitivity, further intensify this vulnerability (Tickamyer & Kusujiarti, 2020).

This situation became evident when a major flood struck Sungai Ambawang District in early 2025, inundating thousands of homes and affecting more than 11,000 residents, including children. Although the government declared an emergency response status and undertook river dredging, the approach remained technocratic and did not yet accommodate participatory social dimensions, particularly the involvement of children (Shrestha et al., 2025).

Table 1: Demographic Profile of Sungai Ambawang District, Kubu Raya Regency

AGE DISTRIBUTION							
0 - 4	5-9	10-14	15-19	20-24	25-29	30-34	35-39
7177	9287	8844	5677	7702	8181	7687	7528
AGE DISTRIBUTION							
40-44	45-49	50-54	55-59	60-64	65-69	70-74	>75
6647	5437	4380	3496	2769	1857	1232	1278
TOTAL:				89179			

Source: Directorate General of Population and Civil Registration, 2024

Children have often been positioned as passive subjects within mitigation programs, despite their capacity to recognize environmental cues and generate solutions informed by their everyday experiences (Fernando, 2024; Fernando et al., 2022, 2023). The disaster justice approach underscores the importance of involving children as a strategic measure in building an inclusive resilience system (Parthasarathy, 2018; Sagala & Paton, 2018). However, most studies continue to focus on the roles of adult communities or the use of local knowledge, and have not yet positioned children as primary participatory actors in risk mapping and identification (Fakhruddin & Elmada, 2022).

Children's participation functions as a mechanism for generating authentic local data while also strengthening collective awareness, adaptive capacity, and social solidarity. This process contributes to the development of resilience across physical, psychosocial, and cognitive dimensions (Winsemius et al., 2018). Therefore, this study aims to: (1) identify hazards through participatory communication carried out by children; (2) conduct disaster mapping to strengthen child community resilience with the support of PGIS; and (3) describe the ideal environment as well as children's expectations regarding their involvement in mitigation efforts.

These findings are expected to support equitable DRR policies and align with the achievement of SDGs 11, 13, and 16 (Djalante, 2018; Widjaja et al., 2022), as well as

strengthen ASTA CITA's values in inclusive development that prioritizes vulnerable communities.

CONCEPTUAL FRAMEWORK

This research builds its conceptual framework on three main pillars: 1) the Concept of Development Communication; 2) the Hazard-Outrage-Based Risk Communication Theory (Covello & Sandman); and 3) the Community Resilience Theory (Paton & Johnston), with a focus on child-centred disaster risk reduction. These three pillars are interconnected to explain how children can act as agents of development communication through participatory disaster mitigation actions.

Development Communication and Children's Participation

The first pillar of this research's conceptual framework draws on the concept of development communication, which is grounded in participation, empowerment, and social transformation. Contemporary development communication has shifted from linear, one-directional models toward dialogic and collaborative approaches, in which communities are no longer passive recipients of information but are recognized as knowledge producers and agents of social change. Within the context of disaster mitigation, development communication plays a critical role in creating participatory spaces that enable communities, including children, to engage meaningfully in decision-making and to implement mitigation actions grounded in their lived experiences.

Previous studies demonstrate that participatory development communication empowers vulnerable communities by fostering critical awareness, strengthening local capacities, and advancing social justice (Setyowati, 2019; Sulistiani, 2020). This approach aligns with participatory research traditions, such as Participatory Action Research (PAR), which provide spaces for community groups to articulate their experiences and aspirations regarding risks. Research has also shown that children's participation in development communication processes can enhance their sense of environmental ownership, reinforce social connectedness, and cultivate sustainable ecological behaviours. In this study,

development communication is therefore positioned not merely as an instrument for information dissemination but as a transformative social learning process that enables children to become active actors in disaster mitigation and community development (Cornish et al., 2023; Fernando et al., 2022).

Risk Communication Theory

The second pillar draws on the risk communication theory developed by Covello & Sandman (2001), specifically model *hazard–outrage*. Notably, their hazard and outrage model. This theory explains that public perceptions of risk are shaped not only by physical or technical hazards but also by social, emotional, and psychological factors that influence how individuals respond to those risks. In this context, risk communication functions not only to convey objective information about potential threats but also to examine how the public, especially children, interpret and respond to risks through their emotional experiences.

The application of hazard–outrage theory in this study helps identify the dimensions of children's risk perceptions in Sungai Ambawang District, which extend beyond natural hazards such as floods and forest fires to include social insecurity, including violence and environmental conflict. Previous research confirms that successful risk communication depends on the ability to build empathy and trust with the target group (Hooker et al., 2017; Malecki et al., 2021; Midtbust et al., 2018). In the context of children, this approach is fundamental because they experience unique forms of outrage that are often overlooked by formal communication systems. Yudarwati et al. (2023) also highlight the importance of locally context-based risk communication and active community involvement to strengthen mitigation effectiveness. Therefore, the hazard–outrage theory in this study serves as a foundation for understanding how the technical and emotional aspects of risk can be integrated into inclusive and participatory communication strategies for children.

The Community Resilience and *Child-Centered Disaster Risk Reduction*

The third pillar draws on Community Resilience theory developed by Paton and Johnston (2001), which conceptualizes community resilience as the outcome of interactions among three key components: adaptive capacity, social participation, and social cohesion (Onyeagoziri et al., 2021). Adaptive capacity refers to the ability of individuals and groups to learn from experience and adjust to environmental changes. Social participation reflects the extent of community engagement in collective activities that enhance preparedness. Social cohesion encompasses the solidarity, trust, and interpersonal relationships within a community that enable mutual support during crises.

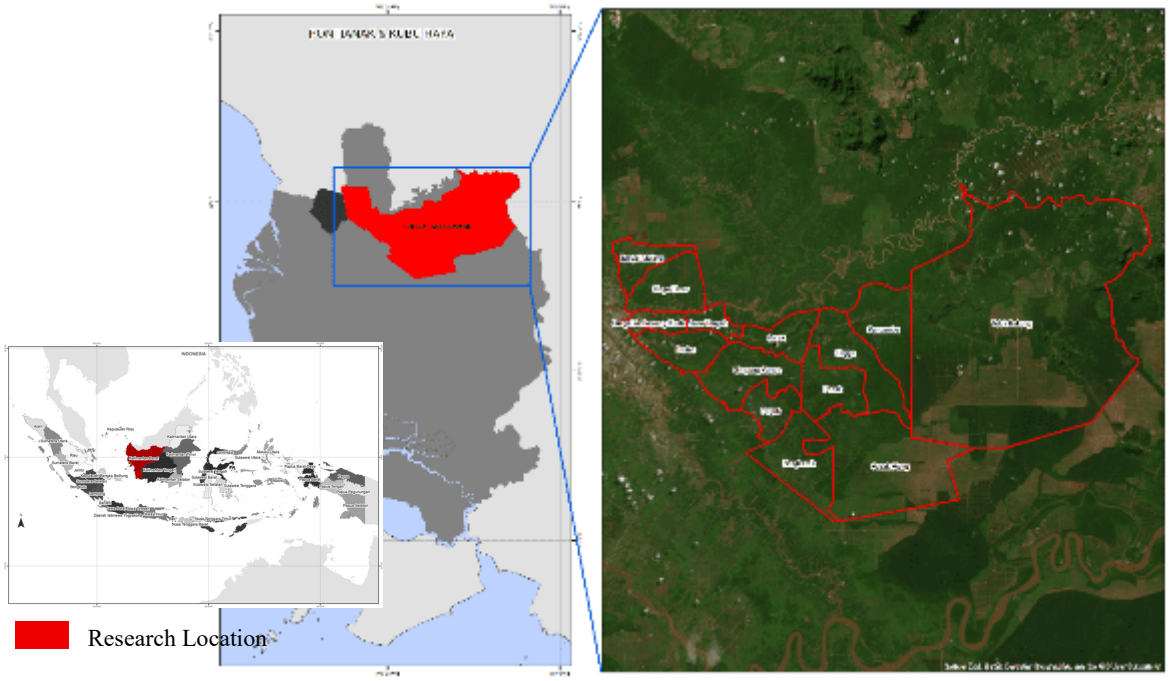
In this study, community resilience theory is integrated with the Child-Centred Disaster Risk Reduction (CCDRR) approach, which positions children as key actors in disaster reduction efforts. Children are understood not only as a vulnerable group but also as active subjects capable of identifying risks, mapping problems, and initiating solutions. Research demonstrates that involving children in DRR activities can strengthen social and psychological capacities within communities, build intergenerational support networks, and enhance adaptive capacity (Krishna et al., 2021; Pfefferbaum et al., 2018). The CCDRR approach also facilitates intergenerational learning spaces that reinforce both social and ecological dimensions of community resilience. In the context of the Sungai Ambawang, this approach is reflected in children's participation in Child-Friendly Participatory GIS (CPGIS), which produces risk maps while simultaneously cultivating collective awareness, social solidarity, and community adaptive capacity in the face of disaster threats (Delicado et al., 2017; Sheehy et al., 2024).

Thus, the Community Resilience theory and the CCDRR approach employed in this study demonstrate that children's participation in disaster reduction can sustainably strengthen both the social and ecological resilience of communities. Children function not merely as recipients of DRR policies but as agents of change who can transform risk communication into inclusive, dialogic, and resilience-oriented development practices.

METHODOLOGY

This research employs a qualitative method using a child-friendly Participatory Action Research (PAR) approach, aiming to create a collective learning space while empowering children as active participants in disaster mitigation. The PAR approach was selected because it aligns with the principles of development communication, which position children as actors who engage in identifying problems, designing solutions, and evaluating follow-up actions through participatory processes (Cornish et al., 2023; Fernando et al., 2024; Kim, 2019).

Figure 1: Research Location



Source: Processed by researchers using ArcGIS, 2025

The research location was in Sungai Ambawang District, Kubu Raya Regency, West Kalimantan, an area with a high level of disaster vulnerability. The primary subjects were 16 children aged 13–17 from the Ambawang Forum Anak community. The research took place on July 14, 2025, at Pama Jubata Protestant Church in Western Indonesia (GPIB). The children were facilitated to understand disaster issues through visual-interactive methods such as images, videos, and dialogue, which are considered effective in transforming children into risk communicators (Satyagraha, 2024).

This study used the Child-Friendly Participatory Geographic Information System (CPGIS) as a supporting tool to map children's perceptions of disaster locations, evacuation routes, and ideal environmental conditions. CPGIS served as a visual medium that complemented, rather than replaced, the primary PAR method and strengthened the participatory process (Meilinarti et al., 2025). All manual maps were then digitized in ArcGIS.

The analysis was conducted thematically, identifying narratives, risk forms, local solutions, and changes in children's understanding throughout the process. Triangulation was conducted through focus group discussions (FGDs), mapping, and field observations. This approach yielded data that was not only educational and contextual but also relevant as a basis for advocating for community-based disaster risk reduction policies that include children's voices.

FINDINGS & DISCUSSION

FINDINGS

The use of participatory communication to empower children as agents of development communication in disaster mitigation represents a progressive and inclusive strategy. Through this approach, children are no longer positioned solely as a vulnerable group. Still, they are recognized as active subjects capable of identifying risks, articulating needs, and effectively conveying mitigation messages to their peers and the wider community. Participatory communication creates dialogic spaces that encourage children to express their ideas through creative media such as drawings, disaster simulations, children's forums, and community radio broadcasts. Within this context, children do more than receive information; they become producers of mitigation messages that are tailored to the language and cognitive styles of their peers, making these messages more accessible and comprehensible. As noted by Sulistiani (2020), participatory approaches that meaningfully involve children in community empowerment initiatives enhance their sense of ownership and increase program effectiveness, including in disaster preparedness.

Similarly, Setyowati (2019) emphasizes that empowerment communication must focus on building community capacity from an early age, with children playing a crucial role in strengthening community resilience. The PAR process in this study provides concrete evidence of how participatory communication can cultivate a risk-aware, disaster-responsive younger generation.

Disaster Identification through Children's Participatory Communication: Risk Matrix-Based Analysis of Sungai Ambawang District

Sungai Ambawang District in West Kalimantan is exposed to various types of disasters, as categorized by the National Disaster Management Agency (BNPB) and the United Nations Office for Disaster Risk Reduction (UNDRR) as natural, non-natural, and social hazards. The risk matrix indicates that the area is affected by floods, tornadoes, forest and land fires, disease outbreaks, and social disruptions, including conflicts related to waste and gambling practices. Flooding constitutes the most dominant hazard in Teluk Bakung, Korek, Pancaroba, and Lingga, leading to infrastructure damage, public health issues, and disruptions to education and economic activities. Land fires, categorized as non-natural disasters, generate haze and degrade air quality, negatively affecting public health, as documented in studies on peat fire smoke exposure in Indonesia. (Uda et al., 2019). On the other hand, social disasters such as environmental conflicts, bullying, and unrest caused by industrial waste can undermine social stability and community resilience, consistent with studies that highlight the importance of social capital in strengthening community resilience (Syahimin, 2023). This complex pattern of vulnerabilities suggests that the Sungai Ambawang requires an integrative, community-based disaster management approach to enhance the community's adaptive capacity and social cohesion.

The matrix in Table 2 shows that various mitigation efforts have been implemented through channels such as social media, posters, bulletin boards, educational videos, and direct community-level interactions. However, these communication patterns are still dominated by a one-way approach centred on government agencies, community organisations, and academic institutions. This situation severely limits children's

participation as communication actors, often positioning them as recipients of information rather than as subjects involved in identifying, managing, and communicating the risks they experience. Yet, research shows that children's participation in disaster risk reduction significantly improves preparedness and the quality of community-based early warning systems (Muzenda-mudavanhu, 2016).

Table 2: Matrix of Disaster Identification for the Ambawang Child Forum Community

The Disaster That Happened	Impacts Caused	Actions That Can Be Taken	Who Should Be Involved	Recommendations for Stakeholders	Effective Communication Channels
NATURAL DISASTERS					
Floods **(the most impactful disaster)** Locations: Teluk Bakung, Korek, Pancaroba, and Lingga	• Traffic jams • Road damage • Teaching and learning process obstacles • Inhibits economic activity • Causes loss of life • Causes various diseases • Damages homes	• Research from the FAA • Tree Planting • Trash Can Construction • Making educational videos • Providing social assistance to flood-affected communities. • Evacuating residents. • Providing health posts.	• Government • Self • Organization • Community • Institution (BPBD) • SAR Team • Community health center	• Provision of social assistance • River widening • Road repair • Relocation Pay more attention to the community and build posts • Provide medical equipment and medicines • BPBD must be responsive	• Social media • Community interaction • Posters • · Wall magazines • · Educational videos
Tornado Location: Teluk Bakung	• Damage to facilities • Resulting in loss of life	• Tree planting	• Government • Society • Organization	• Tree Planting	• Socialization
NON-NATURAL DISASTERS					
Forest and Land Fires Location: Teluk Bakung, Pancaroba	• Haze • Drought • No clean water	• Do not burn rubbish carelessly	• Government • Self • Organization • Society • Institution	• Sanction the perpetrators • Plant trees	• Social media • Creating Community Digital Storytelling (CDST)
Diseases: Smallpox, Dengue	• Loss of life • Transmission	• Cleaning Sewers • Wearing masks • Not littering	• Government • Community Health Center	• Disinfectants • Mask distribution	• Social media • Socialization

The Disaster That Happened	Impacts Caused	Actions That Can Be Taken	Who Should Be Involved	Recommendations for Stakeholders	Effective Communication Channels
Fever, Itchy Rash, and Coronavirus Location: All villages in Sungai Ambawang District	• Disruption of activities • Injuries • Contagious • Medical costs	• Providing medication through health posts • Implementing the 3M (Draining, Covering, and Burying) movement	• Self • Community • Wahana Visi Indonesia • NGOs	• Vaccinations • Free BPJS (Social Security) • Health posts • Water filtration • Education on the dangers of dengue fever • Fogging in every hamlet	• Cleanliness posters • Clean water awareness • Bulletin boards on body care • Traditional ceremonies • Print media (posters/banners)
SOCIAL DISASTER					
Demonstration, Bullying Location: Lingga Dalam	• Public unrest • Trauma	• Negotiation • Socialization	• Government • Community • Parents • Schools	• Imposition of sanctions	• Direct interaction • Education on social media • Involving relevant parties
Hazardous Waste Factory Demo	• Riots • Causes disharmony	• Resolve issues amicably • Effective waste management	• Village Government • Community • Factory	• Awareness from the village government and the factor • Do not dump waste into the river	• Deliberations • Educational videos • Traditional and religious activities
Online and offline gambling **(the most common disaster)**	• Poverty • Stress due to insufficient family needs • Free association among "kids" (drinking, smoking)	• Socialization about the impact of gambling	• Village Government • Police • Schools	• Socialization of village regulations • Blocking online and offline gambling sites	• Social media • ·Print media

Source: Processed by Researchers, 2025

Other findings confirm that inclusive disaster education and communication foster community resilience, particularly in vulnerable areas like Indonesia (Sheehy et al., 2024). Furthermore, children's active participation in disaster education also positively contributes

to their psychological well-being and preparedness to face risks (Krishna et al., 2021). Therefore, in a multi-hazard area like Sungai Ambawang, systematically opening up opportunities for children's participation is crucial to building an inclusive, adaptive community-based mitigation system.

Figure 2: Children's Disaster Mapping Presentation

Source: Documentation by researchers, 2025

In relation to the risk communication theory developed by Covello and Sandman, the results of this matrix indicate the dominance of a hazard-oriented approach. According to Sandman, risk consists not only of technical or objective aspects of hazard but also of emotional, social, and perceptual dimensions, referred to as outrage (Haryono et al., 2022; Rembischevski & Caldas, 2020). In this context, effective risk communication cannot rely solely on technical data but must also consider the social and psychological factors that shape public perception of risk (Hooker et al., 2017).

In the context of Sungai Ambawang, children experience various forms of outrage that are not captured by formal risk communication systems. These include trauma from recurrent flooding, anxiety about the spread of disease, and fear of conflict within their neighbourhoods. However, the absence of child-friendly channels for expression prevents these experiences from being translated into risk information that can support mitigation efforts. This reflects what Covello and his colleagues emphasized, namely that gaps between expert technical understanding and community perceptions can hinder the

effectiveness of risk communication, and that successful communication depends on acknowledging the emotional and social dimensions of risk (Covello et al., 2001).

Furthermore, research shows that public risk perceptions are shaped by two main components, hazard and outrage, which are influenced by social, cultural, and emotional factors such as uncertainty, familiarity, and trust in public institutions (Malecki et al., 2021). Therefore, the theory developed by Covello and Sandman is crucial because it demonstrates that effective risk communication must balance the management of hazard information with attention to the perceptions and emotions of the affected community (González et al., 2014).

Moreover, the matrix in Table 2 shows that several disaster responses have been carried out collectively, such as evacuation, the construction of health posts, hygiene education, and the movement “3M (Draining, Covering, and Burying)”. However, children's involvement in these processes remains passive. On the other hand, there are opportunities for participation that can be optimized by involving children in activities such as creating participatory risk maps, documenting disaster events through creative media, or voicing their needs in village forums. Such activities not only strengthen risk awareness at the individual level but also enhance the overall effectiveness of risk communication.

From Covello and Sandman's perspective, these steps have the potential to build trust between communities and policymakers, enrich the local context of risk narratives, and strengthen collective responses to disasters. Sandman's risk = hazard + outrage model emphasizes that successful risk communication is determined by the ability to balance the technical aspects of dangers with the socio-emotional factors that influence public perception (Rembischevski & Caldas, 2020). In the context of disasters, building communication based on empathy and trust has been shown to strengthen community responsiveness to risks and accelerate the social recovery process (Grabmaier et al., 2025).

This approach also aligns with findings that child-centred disaster risk reduction not only increases children's awareness and capacity but also strengthens the resilience of the community as a whole (Lopez et al., 2012). Involving children in risk communication processes helps uncover forms of outrage typical of young age groups, such as fear, anxiety, and loss of safety, which are often overlooked in formal communication systems (Midtbust et al., 2018).

Therefore, strengthening risk communication in Sungai Ambawang District needs to be directed at systematically and sustainably opening up opportunities for children's participation. This approach aligns with the UNDRR's principles of child-centred disaster risk reduction and the national disaster education policy. It also reinforces the idea that effective risk communication must transform from instructional to dialogic, from elitist to inclusive, and from responsive to participatory. In a society living under the threat of recurring disasters, children are not only vulnerable but also part of the solution.

Disaster Mapping by Child Communities through CPGIS to Strengthen Community Resilience: A Visual Spatial Analysis in the Local Context of the Sungai Ambawang

The results of participatory mapping conducted by a group of children in Sungai Ambawang District using the Child-Friendly Participatory Geographic Information System (CPGIS) approach indicate that children possess spatial and social capacities to identify and articulate disaster risks in their environment. Although CPGIS was not the primary method in this study, it served as a visual learning medium that encouraged children's active involvement in the risk communication process and strengthened community resilience. This participatory approach has proven effective in enhancing risk awareness and enriching community understanding of local conditions, as demonstrated in a Participatory GIS study on flood risk mapping in Mozambique, which successfully integrated local knowledge into the spatial hazard assessment process (Kienberger, 2014).

The children were able to identify and map various forms of disasters they experienced and observed, including floods, forest and land fires, tornadoes, disease outbreaks, and

social disasters such as waste conflicts and gambling. Flooding was the most dominant risk, affecting several villages, particularly Pancaroba, Teluk Bakung, and Lingga. Not only were the children affected, but they also successfully identified safe points, evacuation routes, and infrastructure considered essential and vulnerable. Their ability to represent risks spatially demonstrated a strong understanding of the surrounding environment and the relationship between geographic, social, and disaster risk conditions. This aligns with findings from Public Participatory GIS (PPGIS), which emphasize that community integration into technology-based risk mapping can increase the social relevance and effectiveness of disaster risk reduction at the local level (Kemp, 2008).

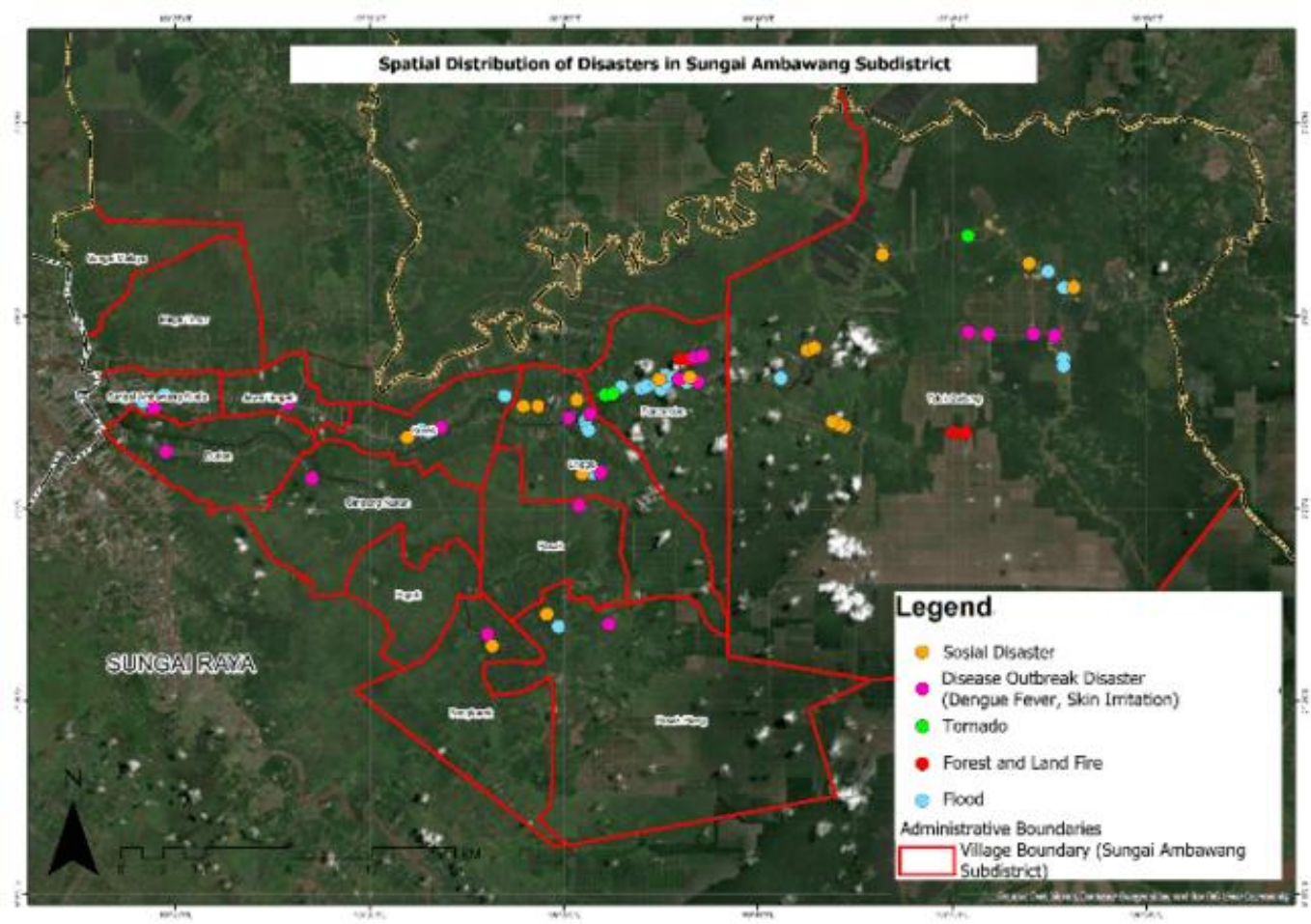
Within the framework of Risk Communication Theory developed by Covello and Sandman, this process can be interpreted as a form of risk communication that combines technical (hazard) and perceptual (outrage) dimensions. Children not only map spatial facts about risks but also convey concerns, anxieties, and emotions regarding their environmental conditions. This model illustrates how risk perception is shaped by the interaction between objective danger and people's emotional responses, and how successful risk communication depends on balancing both. In the context of children, risk communication also serves as a means of psychosocial empowerment, fostering a sense of control and resilience in the face of disasters (Midtbust et al., 2018).

Thus, the CPGIS approach used by children in Sungai Ambawang District plays a role not only in spatial data collection but also in strengthening dialogic, horizontal, and inclusive community-based risk communication. This process demonstrates the real potential of involving children in disaster risk management, where they become active actors in building awareness, articulating emotional experiences, and strengthening the community's social structure in facing risks (Yudarwati et al., 2023).

Furthermore, when analysed through the lens of Paton and Johnston's Community Resilience Theory, this mapping process reveals the emergence of three key elements of community resilience. First, adaptive capacity is reflected in children's ability to understand the causes of disasters, including inadequate spatial planning, the narrowing of river

channels, and the lack of vegetation. Second, social participation is evident in the collaborative mapping discussions, where children share experiences and collectively identify risks. Third, social cohesion is strengthened through the development of mutual trust, solidarity among young residents, and a spirit of cooperation that arises from shared practices.

Figure 3: Distribution of Disasters in Sungai Ambawang District



Source: Processed by researchers using ArcGIS, 2025

These elements align with the community resilience framework that highlights the importance of social capacity, adaptation, and collective learning in responding to disasters (Ostadtaghizadeh et al., 2015) and reinforce the finding that community engagement is a key prerequisite for building sustainable resilience (Bromley et al., 2017).

PGIS also has a significant educational function. Spatial visualization allows children to understand risks within the context of their living spaces concretely. They don't just memorize disaster hotspots but also understand the spatial dynamics that can support or hinder mitigation. The resulting maps are collective representations that are not only informative but also reflective and can be used as advocacy materials for stakeholders at the village level and for educational institutions. This aligns with research showing that Participatory GIS can increase spatial awareness, technical capacity, and community reflection in disaster mitigation planning (Liu et al., 2018).

Another interesting finding was the children's awareness of the limits of their spatial knowledge. Some villages were not mapped because they were considered remote or unfamiliar. This awareness reflects the capacity for reflection and the potential to expand interregional networks through horizontal collaboration. The children suggested broader involvement from peer communities in other villages to make the mapping process more representative and inclusive. This approach aligns with the concept of participatory resilience, where cross-community collaboration can strengthen social solidarity and collective adaptability to risks (Mahajan et al., 2022).

Thus, child-based participatory mapping using CPGIS not only generates spatial data on risks but also strengthens community-based risk communication and builds essential elements of resilience. This process positions children as active subjects able to observe, assess, and communicate risks in context. The results are not only relevant for local mitigation strategies but also make a tangible contribution to the development of more participatory, inclusive, and sustainable disaster risk reduction models (Margarena et al., 2023).

Ideal Environment and Children's Expectations to Contribute to Disaster Mitigation in Kubu Raya Regency

Children in Sungai Ambawang District conceptualize an ideal environment as the outcome of a healthy relationship between ecological conditions, infrastructure, and social life. In

participatory discussions and PGIS mapping activities, they described not only disaster-free spaces but also their own roles in creating and maintaining such spaces. Their vision of an ideal environment includes appropriate land use, the presence of water absorbing vegetation, clean and functional roads and rivers, and a socially safe setting for vulnerable groups, including children. This understanding is consistent with findings from a participatory mapping study in Switzerland, which demonstrated that community involvement, including the engagement of children, can strengthen ecological awareness and promote sustainable environmental practices by integrating local knowledge and participatory spatial approaches (Reichel & Frömming, 2014).

On the ecological front, children demonstrated a strong understanding of the role of vegetation, particularly trees, in reducing the impacts of disasters such as floods and tornadoes. They emphasized not only the importance of tree planting but also the selection of tree species and their capacity to absorb water. This perspective reflects an ecological awareness shaped by their direct experiences with landscape changes caused by deforestation and land conversion, consistent with research in rural communities in Colombia showing that participatory approaches in rural schools can cultivate awareness of environmental risks (Moncayo et al., 2023).

Furthermore, children's attention to air quality, which they associate with blue skies and a smoke-free environment, suggests an emotional dimension to their ecological perceptions. This reflects a response to their experiences with haze from wildfires, similar to findings from a community-based disaster risk reduction study in a wildfire-prone area of Portugal, where residents associated air quality and vegetation with a sense of ecological security and community identity (Partidário et al., 2022).

Moreover, children's perceptions of an ideal environment as clean, green, and safe demonstrate a holistic understanding of the interconnectedness of ecological, infrastructural, and social dimensions. This perspective aligns with a socially inclusive infrastructure approach to disaster risk reduction, which emphasizes the importance of

social equity and cross-community collaboration to build resilient and sustainable living spaces (Lunga et al., 2025).

On the infrastructure side, children identified narrowed rivers and potholed roads as factors that exacerbate the impact of disasters. Rivers clogged with weeds or waste accelerate flooding, while damaged roads hamper evacuation processes and endanger residents. They expressed their aspirations for river widening and road repair as integral to a safe and ideal environment. This demonstrates their understanding of the critical role infrastructure plays in a community's capacity to cope with disasters. This understanding aligns with findings from a study in Bangladesh showing that poor infrastructure increases children's vulnerability to flooding and climate disasters, and that risk-reduction strategies must integrate child-friendly built-environment design.

Figure 4: Ideal Environment and Hope Images

(DRE, 17)

(CL, 17)

(JNX, 15)

Source: Informant image results, 2025

Furthermore, recent research shows that while new infrastructure development is often considered a post-disaster solution, social and spatial vulnerabilities persist due to a lack of community participation in planning and maintaining such infrastructure. In this context, infrastructure upgrades without social integration can perpetuate the cycle of community vulnerability to environmental risks (Valencia Londoño & Valencia Londoño, 2024).

In the social dimension, children regard safety as an essential component of an ideal environment. They associate social conditions with concerns such as violence, bullying, and insecurity in their homes and schools. This view underscores that disaster mitigation is not limited to natural risks but also involves protection from social threats that children experience directly. This perspective is supported by research in Europe showing that children have the capacity to identify and advocate for forms of social risk that are often overlooked by formal policy systems, making it critical to position children as active participants in *child-centered disaster risk* reduction systems (Jogia & Wedawatta, 2019). One of the informants said that:

" There was a lot of violence in that neighborhood... even biological parents raped their children. So I wanted to create a safe and bright environment for children, free from predators. " (DRE, 17 years old).

In addition to conveying the concept of an ideal environment, children have also contributed to mitigation efforts. They have been involved in tree planting, seed distribution, and environmental cleanups in play areas and public spaces. These actions are not merely symbolic responses, but part of a collective awareness that change can begin on a small scale, close to their lives. Children's involvement in concrete actions like these have been shown to increase community preparedness and strengthen household capacity in responding to disasters. (Lam & Huang, 2018). One of the children said:

" We immediately wanted to go down, pick up the trash that was around the place where we often hung out and played. " (JNX, 15 years old).

Furthermore, children demonstrate temporal awareness in disaster mitigation. For example, tree planting is carried out during the dry season so that roots can grow optimally before the rainy season. This awareness indicates that their participation has moved

beyond the symbolic stage to practices based on ecological knowledge and natural cycles. This aligns with research in Brazil that found that involving young people in early warning systems and citizen science can increase awareness of the timing and patterns of environmental risks in a sustainable manner (Marchezini et al., 2017). One of the informants said that:

"We do it now, and later when the tree grows, it can help to absorb water so that there is no flooding." (CL, 17 years old).

Overall, children's hopes and contributions to disaster mitigation reflect an intergenerational understanding of resilience. They not only perceive risk as external but also position themselves as part of the solution. This perspective aligns with the child-centered resilience approach, which positions children as agents of change who can strengthen communities' social and ecological resilience through collaborative, empathetic actions. Thus, children in Sungai Ambawang District have demonstrated that an ideal environment is not merely a future aspiration, but is being and has been working towards it through concrete actions, both physical and educational.

DISCUSSION

The findings of this study confirm that children in Sungai Ambawang District have the substantive capacity to play an active role in disaster risk reduction (DRR). Through participatory approaches such as the Child-Friendly Participatory Geographic Information System (CPGIS), children function not only as recipients of information but also as producers of local knowledge about risk and mitigation. They can map the types, locations, and impacts of disasters based on direct experience, while also articulating ideas for an ideal environment that is safe, green, and socially inclusive.

In the context of Paton and Johnston's (2001) theory of Community Resilience, these children's involvement reflects three main components:

1. Adaptive capacity, namely the ability of individuals and communities to learn from experience and adapt to risks. Children demonstrate this through ecological understanding, linking the relationships between vegetation, water flow systems, and flood potential. This awareness is similar to the findings of Liu et al. (2018), who showed that community participation in participatory risk mapping strengthens adaptive knowledge and the community's ability to reflect on environmental dynamics.
2. Social participation, evident in children's involvement in concrete activities such as tree planting, waste management, and the development of environmental educational messages. These activities serve not only a symbolic function but also serve as a means of ecological and social learning that fosters a sense of ownership over their living space. Krishna et al. (2022) showed that children's active participation in disaster education contributes to increased self-efficacy, mental resilience, and positive social relationships among participants.
3. Social solidarity, as seen in the way children understand the importance of cooperation between residents, the government, and community leaders. This solidarity forms the foundation for collective resilience, namely the ability of communities to survive and recover through mutually reinforcing social networks. A study by Pfefferbaum et al. 2018) confirmed that children's involvement in Disaster Risk Reduction activities strengthens social connections among community members and creates effective support networks in crises.

Furthermore, the children's perspectives on the ideal environment they developed through the CPGIS process broadened the definition of disaster mitigation. They understood that risks stem not only from natural hazards such as floods or forest fires, but also from social violence and structural insecurity around their homes and schools. This perspective marked a significant shift from a hazard-centered paradigm to a human-centered disaster reduction paradigm, where social, emotional, and psychological factors become integral to risk reduction (Delicado et al., 2017). Thus, mitigation for children is not just about building physical infrastructure, but also about creating safe and equitable social spaces.

The results of this study also reinforce the relevance of the Child-Centered Disaster Risk Reduction (CCDRR) approach, which views children as agents of change in building community resilience. This approach emphasizes that empowering children not only increases their resilience but also enhances the preparedness of families and communities as a whole (Krishna et al., 2022). Through active participation in the mapping process and community dialogue, the children in Sungai Ambawang have demonstrated that resilience can be built from the ground up, by utilizing everyday experiences as sources of adaptive learning.

Table 2: Illustrates theoretical frameworks are connected to the findings of the study

Theory	Description	Connection to Findings
Development Communication	Focuses on participatory, empowerment, and social transformation through communication.	The study found that involving children in disaster mitigation through participatory communication enhances community engagement and resilience. This aligns with the empowerment focus of development communication.
Risk Communication Theory	Explains how people perceive and respond to risks based on technical, emotional, and social factors.	Children's emotional and social responses to disaster risks, such as fear of floods and desire for a safe environment, align with Risk Communication Theory, demonstrating that risk perception is influenced by both hazard and emotional factors.
Community Resilience Theory	Emphasizes the adaptive capacity, social participation, and cohesion in communities facing disasters.	The study demonstrated that children's participation in risk mapping and community-based initiatives enhanced community resilience, showing that involving children builds adaptive capacity and social cohesion, key components of Community Resilience Theory.

In addition, interactions among children and stakeholders in communication forums demonstrate the emergence of intergenerational learning, where children's local knowledge enriches adults' perspectives on risks. In contrast, children gain structural support from their communities. This aligns with the concept of the Resilient Children, Resilient Communities Initiative, developed by (Balkaran & Schlegelmilch (2024), which emphasizes the importance of a child-based resilience model to strengthen community preparedness as a whole.

Thus, children's participation in DRR in Sungai Ambawang District is not only a demonstration of inclusivity but also evidence that children play a strategic role in

transforming risk communication into a dialogic and collaborative process. Through practices such as CPGIS, they construct new understandings of human-environment relationships, expand the scope of mitigation into sustainability-oriented social action, and build the foundation for participatory, equitable, and sustainable community resilience.

CONCLUSION

This study demonstrates that children in Sungai Ambawang District possess substantial capacity to recognize, understand, and respond to disaster risks through a participatory communication process supported by CPGIS. They were able not only to map disaster locations and types based on their direct experiences but also to articulate their perceptions of an ideal environment that reflects an integrated understanding of ecological, infrastructural, and social conditions. In the context of community resilience, children demonstrated key elements, including adaptive capacity through reforestation and waste management initiatives, social participation through educational activities and the production of visual messages, and collective cohesion through awareness of cross-actor collaboration. Children identified and mapped multiple forms of disasters they had experienced or observed, including floods, forest and land fires, tornadoes, disease outbreaks, and social disruptions such as waste-related conflicts and gambling. Flooding emerged as the most dominant hazard, with widespread occurrence across several villages, particularly Pancaroba, Teluk Bakung, and Lingga. In addition to identifying affected areas, children successfully identified safe points, evacuation routes, and infrastructure that they considered essential or vulnerable. Their vision of an ideal environment extends beyond a green and healthy physical space to include protection from violence and the presence of functional infrastructure, as illustrated in their participatory drawings. These findings reinforce the importance of a child-centered disaster risk reduction approach within local disaster policies, which not only protects children but also recognizes them as active contributors to community resilience. Therefore, it is recommended that government and civil society institutions provide greater space for children's voices, actions, and leadership in the planning, implementation, and

evaluation of disaster mitigation policies, including through the integration of PGIS methods into school and community-based disaster education programs. Educational institutions should also incorporate participatory disaster risk reduction practices into their curricula, enabling children to actively engage in identifying and addressing risks. Furthermore, government agencies should prioritize child-centered approaches in disaster preparedness and response, ensuring that children are not only protected but empowered as key stakeholders in resilience-building efforts.

LIMITATION AND STUDY FORWARD

This study has several limitations that should be carefully considered when interpreting the findings. First, the number of participants was relatively small and drawn from a single Forum Anak community in Sungai Ambawang District. Hence, the perspectives of children from other villages or districts in Kubu Raya were not fully represented. Second, the risk-mapping process using Child-Friendly Participatory GIS (CPGIS) relied entirely on children's spatial knowledge, leaving unfamiliar areas unmapped and potentially introducing spatial bias. Third, interactions with stakeholders, including village officials, the Regional Disaster Management Agency (BPBD), and educational institutions, were limited to initial observations, thereby restricting the integration of children's voices into formal disaster risk reduction policies.

Future research can be developed through several strategic directions. First, expanding participation to other villages in Kubu Raya Regency or other disaster-prone areas in West Kalimantan would enrich children's perspectives and enable comparative analysis across regions. Second, involving a broader range of actors, including parents, teachers, community leaders, and government institutions, could strengthen data validity and create opportunities for intergenerational dialogue in the development of disaster risk reduction policies. Further research could also examine the effectiveness of child-generated risk maps as advocacy tools at the village level and develop more age-sensitive and context-specific risk communication models that integrate the hazard and outrage perspective with children's ecological and social experiences. Additionally, future studies could

incorporate sentiment analysis to assess the emotional responses of children to different types of disaster risks, helping to understand their psychological engagement in disaster risk communication. Comparative studies could also be conducted between regions with varying levels of disaster preparedness to assess how children's participation in risk communication influences community resilience in diverse contexts. In this way, future research could not only strengthen participatory approaches but also influence the design of disaster risk reduction policies that are more inclusive and responsive to the needs of younger generations.

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