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Tempe Lake Flood Challenges Inspire Community Adaptation, Wajo District, Indonesia

Riri Amandaria [1)], Idham Irwansyah Idrus [2)], Sopian Tamrin [3)]
[1, 2, 3)] Department of Sociology and Anthropology, University of Negeri Makassar, Indonesia
Corresponding Author: Riri Amandaria, Email: ririamandaria@unn.ac.id

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Abstract. The Tempe Lake area is faced with flooding problems that routinely cause losses and disrupt the survival of households. This research was conducted in Tempe sub-district, located in Wajo district, South Sulawesi, presenting an important segment of the wider Tempe Lake region with using a case study approach, the research focused on households in the Lake Tempe community. This study examines the resilience of households inundated by flooding, focusing on income stability, settlement sustainability, food security, disease prevention, and disaster management patterns. The results revealed that the people of Tempe Lake have an extraordinary ability to harmonise tradition and innovation, allowing them to survive and thrive. The cleverness of the community is evident in the raising of the floor of houses to adjust to the ever-changing water levels, making footbridges for access to fellow residents and to public spaces, using sampan boats as a means of water transport, facilitating mobility to farms and public spaces, and alternative businesses, with the support of the local government and other institutions that sustain the lives of flood-affected communities. Remarkably, despite the constant flooding, people still choose to stay because they are driven by the close bonds of their community and the many income opportunities derived from rice farming, capture fisheries, and various job prospects in the vibrant city centre of Sengkang which makes the existence of Tempe Lake beautiful. Thus, the pattern of community adaptation is a knowledge that can be used as a reference for disaster management agencies in formulating a comprehensive work plan.

Keywords: *Resilience; Innovation; Interaction; Natural disaster; Adaptation*

INTRODUCTION

Adaptation to natural change is an inherent process in all living things, including community responses to flooding. Flood events, both those caused by natural changes and those exacerbated by changes in climate patterns, encourage shifts in people's strategies to (Alhassan, 2020; Tambo, 2016; Zain, 2022). These evolving methods of adaptation not only enable communities to cope with existing flood challenges, but also foster resilience that equips them to face future floods with greater fortitude (; (Dinh et al., 2012; Irwan et al., 2022; Nguyen & James, 2018).

Flooding in Tempe Lake follows an annual pattern, a recurring event that seems to be increasing. According to the Makassar Meteorology Climatology and Geophysics Centre Region IV in 2018, the water flow into Tempe Lake mostly comes from the Walane watershed in the west season (October-January) and switches to the Bila watershed in the east season (February-June). However, the situation is getting dire due to the influence of climate change. As climate change continues, the frequency and volume of floodwater increases, exacerbating erosion in the watershed. This erosion, in turn, leads to siltation, with profound consequences for the

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overall health of the lake and increased risk of overflows (Gentle & Maraseni, 2012; Simonneau et al., 2013; Yu et al., 2017).

In repeated cycles of flood events, challenges act as catalysts, encouraging proactive responses from communities. This becomes a valuable learning experience, fostering individual and collective resilience that shapes preparedness behaviour. (Arouri et al., 2015; Folke, 2003a; Soeprobowati, 2015a; Terpstra & Gutteling, 2008). Collective responses to recurrent flooding as a form of socio-ecological disruption, thus demonstrating adaptability through reorganisation, development and innovation, taking advantage of existing opportunities Click or tap here to enter text. (Folke, 2003b; Khanal et al., 2018). Recurrent and annual floods and droughts have become an integral part of their lives, forming a prominent social resilience (Folke, 2003; (Asti, 2012; Nguyen & James, 2013; Utami et al., 2017; van Dillen, 2003). This metamorphosis in perceptions and coping mechanisms not only demonstrates community resilience. However, communities investigate the transformative nature of experiences and become cumulative knowledge acquired over time, thereby fostering community proficiency in dealing with the challenges posed by flooding (Asti, 2012; Nguyen & James, 2013).

Various studies have been conducted by various experts related to the topic of community adaptation to climate change (Mendelsohn, 2008)(Mertz et al., 2009) (Feinstein, 2018). Particular attention has been dedicated to understanding the impact of drought on farmers' livelihoods (Brüntrup & Tsegai, 2017; Kawasaki & Herath, 2011) and the impacts of drought and flooding of rivers or estuaries on agriculture (Feinstein, 2018; Wilby & Keenan, 2012; Winsemius et al., 2016). However, despite the plethora of research on climate-related adaptation, there is still a significant gap in the literature regarding specific patterns of adaptation to flooding in lakes, especially within communities such as those around Tempe Lake. The unique dynamics and challenges associated with lake flooding demand focused research to contribute meaningful insights to the broader discourse on community resilience and adaptation in the face of environmental change. As Tempe Lake grapples with recurring flooding issues, understanding local strategies and community responses becomes critical to developing targeted and effective mitigation and adaptation measures.

This research aims to comprehensively investigate different patterns of community responses to flooding, with particular emphasis on important aspects such as income and shelter sustainability, food security, disease prevention, and crisis management systems. The ultimate goal is to gain deeper insights into how communities deal with the various challenges posed by recurrent flooding. By studying these key dimensions,

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this research seeks to offer a deeper understanding of the strategies and mechanisms used by communities to cope with and adapt to the impacts of flooding. Through this exploration, the research aims to contribute valuable knowledge that can inform the development of effective and context-appropriate interventions, thereby enhancing communities' resilience in the face of persistent flood threats.

The insights gained from this research are more than just information, but also have practical significance with potential applications in various fields. As a valuable reference, these insights can empower disaster management agencies to formulate more effective work plans that are tailored to community needs and capacities. Local governments equipped with this knowledge can design programmes tailored to the local context, thereby promoting more targeted and impactful interventions. Similarly, non-governmental organisations engaged in disaster response and community welfare can utilise these findings to develop assistance strategies that are in line with the vulnerabilities and strengths of communities, particularly those living around Tempe Lake. In essence, this research aims to bridge the gap between theoretical understanding and practical application, contributing to the development of more resilient and adaptive communities in the face of persistent flooding challenges.

RESEARCH METHODS

This research was conducted in Tempe sub-district, located in Wajo district, South Sulawesi, which represents an important segment of the wider Tempe Lake region. Using a case study approach, the research focused on households in the Lake Tempe community. Informants were selected from a variety of groups, including farming households, farmer group administrators, fisher households, pump irrigation service business managers, village government officials, and employees of the national disaster management agency in the area. The data collection process centred on understanding the impacts experienced and the action patterns of the community during floods. This included aspects such as livelihoods, losses experienced by households, types of illnesses encountered, and appropriate mitigation strategies. In addition, this research also studies social dynamics, which include internal community activities and external symbols that affect Tempe Lake. By comprehensively examining these aspects, this research seeks to provide a deeper understanding of community responses to flooding, taking into account multiple perspectives and contributing valuable insights to inform future interventions and resilience-building strategies in similar contexts.

By conducting descriptive analyses of the qualitative information collected, this study systematically explores the detailed

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characteristics, themes, and patterns inherent in the data. This careful exploration aims to build a comprehensive and detailed picture of the patterns of action and impacts experienced by the Lake Tempe community in response to flooding. The chosen approach facilitated an in-depth understanding of the community's adaptation strategies in a structured manner. The analysis process involved several important steps, with categorising and organising information, followed by thematic analysis to identify dominant themes and patterns. In addition, the selection of illustrative examples played an important role in explaining key points and enhancing the richness of the findings. Through this methodical process, this research aims to provide a nuanced and holistic perspective on patterns of community adaptation to flooding, which forms the basis for informed decision-making and targeted interventions to improve the resilience of Lake Tempe communities and similar contexts facing recurrent flooding challenges.

DISCUSSION

Flood Dynamics in Tempe Lake

Flood peaks occur twice a year: the first is in May or June, influenced by rainfall in the eastern region of South Sulawesi from the Bila watershed with catchment areas in Enrekang, Sidrap, Soppeng and Wajo districts; the second is in December or January, influenced by rainfall in the western region from the Walane watershed with catchment areas in Maros and Barru. The rice crop period lasts about four months which is faced with the risk of flooding at the beginning or at the end of the growing season. The risk of failure is higher in the January-May planting season compared to the failure in the September-January planting season.

Flood peaks in the Lake Tempe area follow a semi-annual pattern, occurring twice a year. The first peak usually occurs in May or June and is mainly influenced by rainfall in the eastern region of South Sulawesi, originating from the Bila watershed. This watershed covers the catchment areas of Enrekang, Sidrap, Soppeng and Wajo districts. The second peak occurs in December or January and is influenced by rainfall in the Western region, which originates from the Walane watershed with catchments in Maros and Barru districts.

The rice harvesting period lasts for approximately four months, so high flood risk can occur at the beginning or end of the growing season. The risk of crop failure is higher in the January to May growing season compared to the September to January growing season, indicating a critical period of vulnerability for agricultural activities in the Lake Tempe region. Understanding these temporal variations is critical to designing targeted strategies to reduce the impact of flooding on community agricultural livelihoods.

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In the context of Tempe Lake, the cycle of natural events is not only seen as a series of environmental phenomena, but also deeply embedded as a rhythm of life. Local perspectives recognise that life is characterised by a balance between benefits and challenges, a constant ebb and flow. There is a prevailing belief that existence does not always have to be characterised by profit or pleasure alone; rather, it encompasses an understanding that gains and losses come and go. However, the enduring expectation is that gains outweigh losses, a sentiment echoed in the work of (Mechler, 2005; Mechler & Risk, 2000). After the flood disaster in Lake Tempe, communities generally experienced losses in various forms, including damage to homes and furniture, illness among family members, and decreased income due to crop failure and job loss. Among these, the form of loss most felt by the community was crop failure, which was an unavoidable consequence, and health problems among family members. This nuanced perspective underscores the complex relationship between communities and recurrent flooding, framing these challenges not just as disruptions but as integral components of the enduring rhythms of community life.

The continuous flooding has affected the rhythm of people's lives in Tempe Lake as a routine occurrence, thus affecting people's work patterns. The community rests during the flood period, so there are not many people looking for work. Common illnesses felt by the community include flu, skin diseases and coughs. The community copes by visiting the Puskesmas if it is considered serious or simply buying medicine at a stall/kiosk if the illness is considered mild. The impact of flooding on health is considered a normal thing and can be overcome easily. Households' confidence in securing their homes not being affected by a large flood event (Nguyen & James, 2013; Soeprobowati, 2015b).

The constant inundation of Tempe Lake has disrupted the rhythm of life for the community, making flooding a regular occurrence that significantly affects their daily routines and work patterns. During periods of flooding, communities often experience a temporary lull, with fewer people actively seeking work due to the challenging conditions. In terms of health, common illnesses in the community during these times are flu, skin diseases and coughs. To address health issues, the community adopted a pragmatic approach, seeking medical attention at the Puskesmas for more severe cases, while opting to buy medicine at local stalls or kiosks for milder ailments. Remarkably, the community perceived the health impacts of flooding as a normal occurrence in their lives, and considered it a challenge that could be easily overcome. This resilience is further reflected in households' confidence in securing their homes from potentially significant flood impacts (Nguyen & James, 2013; van den

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Berg, 2010). Despite the disruption caused by continuous flooding, the people of Tempe Lake demonstrate adaptability and a pragmatic approach in dealing with the challenges posed by this recurring environmental phenomenon.

Lake flooding is a poignant and important manifestation of the widespread impacts of climate change. This phenomenon is particularly pronounced in lake environments due to the inherent role of lakes as natural conduits for river systems . (De Bruijn, 2004; Nakakaawa et al., 2015). In addition to being water reservoirs, lakes have diverse roles in regulating benefits and risks in the regions they affect (Soeprobowati, 2015a; Vadeboncoeur & Steinman, 2005) The complex interplay between ecological dynamics in lakes is particularly exemplified in the context of Lake Tempe, where the sustainability of rice farming is strongly linked to the effective functioning of production institutions. These institutions bear the responsibility of overseeing the equitable distribution of benefits and risks, thus playing a critical role in shaping the adaptive capacity of local communities amidst the challenges posed by climate-induced flooding. As Lake Tempe grapples with the far-reaching consequences of climate change, the efficacy of these institutions becomes critical in driving sustainability and resilience in the region.

Surprisingly, the resilience of communities living around the lake has remained unwavering in the face of recurrent flooding. Despite the hardships posed by the excess water, these communities persist in various production and service activities. It is this extraordinary flooding phenomenon, which highlights the resilience of these communities. What sets them apart is their remarkable ability to adapt to the challenges posed by flooding through various strategies. (Artur & Hilhorst, 2012; Khailani & Perera, 2013). The resources and adaptability demonstrated by these communities. Their ability to not only survive environmental challenges, but also thrive in the midst of adversity. This resilience not only sustains their way of life, but is also a testament to the human ability to innovate and overcome even the most formidable environmental obstacles (Karim & Thiel, 2017; Saroar & Routray, 2015).

Source of Livelihood

The community's decision to settle around Tempe Lake is strongly influenced by the income factor, which is a barometer of their resilience in dealing with frequent flooding in the area. When households can rely on their income to fulfil their needs, it reflects a high level of resilience in facing the challenges posed by frequent flooding around Lake Tempe. The community's main sources of income revolve around the food agriculture sector, mainly centred on rice cultivation, and the capture fisheries sector in Tempe Lake, as a public body of water. The superiority of agriculture and fisheries as the main providers

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of employment is an attractive incentive for people to choose Tempe Lake as their place of residence. Dependence on agriculture, especially rice cultivation, increases due to sufficient water supply coming from Tempe Lake, which constitutes about 90 per cent of the total income. The remaining 10 per cent is diversified across various occupations outside the agricultural sector, covering activities such as carpentry, construction labour, and kiosk business. This economic structure not only sustains the community's livelihood, but also underscores the intricate relationship between their income sources and the natural resources offered by Tempe Lake, positioning the community's resilience as closely linked to the sustainable utilisation of their environment.

The land use system in the agricultural business around Tempe Lake shows a tripartite division into three different categories, each offering a unique approach to cultivation. These categories include land cultivated by the owner, land rented or mortgaged, and a profit-sharing system where some farmers use a combination of land tenure types. Specifically, about one-third of the farmers in the Tempe Lake region choose to grow rice under a rental system, while another third manage their own farmland. The economic backbone of the community relies heavily on rice farming, with a significant proportion of the community's monthly income, ranging between 2-3 million, coming from this agricultural activity.

For those with more limited land and lower incomes, a multifaceted approach to income generation is evident. In addition to rice farming, they also engage in additional activities such as fishing in the lake, and working off-farm or in the non-farm sector. These diversified income strategies are particularly important for those facing constraints due to smaller landholdings, to ensure a stronger financial portfolio for their families. The ability of communities to utilise multiple sources of income, spanning agriculture, fisheries and non-farm sectors, underscores their adaptability and resilience. This approach not only enhances their economic stability, but also reflects a pragmatic response to the challenges posed by varying land tenure structures and the limited availability of agricultural land in the Lake Tempe region.

Rice farming practices in the Tempe Lake region largely rely on pump irrigation systems that draw water from the lake. However, the inherent risk of flooding poses a major challenge to this agricultural endeavour, often leading to planting or harvesting failure. The recurrent nature of flooding forces farmers to conduct planting activities up to three times in a season, or in unfavourable cases, experience complete crop failure. These agricultural disasters have significant financial implications for farmers. After such setbacks, farmers are exempted from paying irrigation water fees. In addition, they are given the

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flexibility to defer payment of production input debts without incurring additional borrowing costs, with the understanding that outstanding payments will be met in the next harvest. These arrangements reflect a pragmatic response to the unexpected challenges posed by flooding, providing relief to farmers grappling with the uncertainty of Lake Tempe's environmental dynamics. Such adaptive measures not only alleviate the immediate financial burden but also contribute to the resilience of the farming community, enabling them to navigate the uncertainties associated with the unique agricultural landscape of the region.

Lake Tempe, located on the outskirts of Sengkang, the capital city of Wajo Regency, has its own charm that fosters a sense of contentment among its inhabitants. Communities have not just resigned themselves to the challenges posed by climate change, especially the looming threat of flooding; instead, they have taken innovative measures as evidence of their resilience . (Motsltolaplte et al., 2014; Yusran et al., 2019). Notably, some people have adopted unconventional dwellings such as floating houses and mobile homes, demonstrating proactive adaptation to environmental dynamics.

Although a small portion of the community is engaged in off-farm employment, what truly sets this area apart is the incredible creativity of the people in adapting to their environment, ensuring the preservation of their quality of life in the midst of change. The reluctance to part with Lake Tempe is further emphasised by the economic landscape. Asset values, including houses and yards, are still very low compared to other areas. This factor, coupled with very high land prices in alternative areas for gardening and farming, makes Tempe Lake an economically viable and attractive option. The relatively difficult livelihood prospects in alternative areas also contribute to the community's commitment to stay by the lake. At its core, Tempe Lake serves not only as a geographical landmark but also as a testament to human ingenuity and adaptability, as communities creatively navigate the impacts of climate change while maintaining a deep-rooted connection to their unique environment.

Adaptation pattern

Communities living near Tempe Lake use a variety of strategies to address the recurring challenges posed by flooding, with five important activities being prioritised. Foremost is the practice of raising house poles, an important adaptation effort that involves raising the foundations of houses to reduce the impact of flooding. The strategic use of bamboo is not only as a safeguard for household furniture, but also as a versatile material for constructing walkways that connect houses to public roads. This clever approach ensures accessibility not only

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between neighbouring houses but also to vital public infrastructure.

Among the adaptation measures taken, communities placed significant emphasis on the safety of household furniture, often prioritising this before any other measures. Bamboo, with its unique qualities, became an integral component in the construction of elevated household furniture and doubled as a footbridge.

In addition, the provision of small boats or canoes is also a practical adaptation strategy. These boats have a dual function, as a means to catch fish around the house and as a means of transport, including access to rice fields during floods. What is interesting about this practice is the prohibition on the use of engines when sailing around the house, as the waves generated could potentially damage the structure of the house. These diverse flood adaptation approaches demonstrate the community's ability and resilience in facing environmental challenges with a combination of traditional practices and innovative solutions.

Within the communities living near Tempe Lake, the recurring phenomenon of flooding has been transformed from a mere disaster to a manageable event, thanks to the collective experience and skills of the residents. Annual flooding, instead of being perceived as a disaster, is now seen through the lens of adaptability. Among the diverse perspectives communities have on flooding, two are perceived to pose significant risks. These include potential threats to food security and increased costs of agricultural production. Apart from these identified challenges, other dimensions such as public health, sources of income and overall security were not perceived as issues during flood events.

This different perspective illustrates a transformative shift in the community's approach to flooding. What was once perceived as a potential disaster, has now become an opportunity to develop adaptation strategies. This metamorphosis in perceptions and coping mechanisms not only demonstrates the resilience of communities, but has investigated the transformative nature of these experiences, emphasising how cumulative knowledge gained over time has fostered communities adept at dealing with the challenges posed by flooding (Asti, 2012; Nguyen & James, 2013). This adaptability is not simply a reaction, but rather a proactive response, demonstrating the dynamic relationship between human communities and their environment in the face of ongoing challenges.

Everyyear, local governments demonstrate consistent commitment by consistently providing assistance to flood-affected communities, as a manifestation of institutional responsibility. In contrast, assistance from the central government and various social organisations is strategically directed during peak flood periods, which

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occur in a cyclical pattern every five years. The main form of assistance was in the form of basic foodstuffs, including instant noodles, sugar and cooking oil. Recognising the particular challenges faced by the poor and those whose homes are submerged, village governments take the additional step of providing rice to alleviate their hardships. This targeted assistance ensured that the most vulnerable members of the community received the necessary support during critical times. In addition, communities also benefited from the distribution of bamboo, a versatile resource used to construct important walkways, emphasising the comprehensive approach taken to address both immediate needs and long-term resilience. The coordinated efforts between local and central government, coupled with the proactive use of distributed resources by the community, exemplify a collaborative and adaptive response to the recurring challenges posed by flooding.

After the floods, local governments and social organisations reached out to help all affected residents, providing them with essential supplies, mainly including instant noodles. However, there were exceptions for those who chose to vacate their homes during the flood period. Remarkably, only a small percentage, ranging between 10-15 per cent of the community, consistently made the decision to temporarily leave their homes during the peak of the floods. Typically, this group consists of households that have alternative employment options in different locations or individuals who have close family ties living around Tempe Lake. For this proactive group of people, Tempe Lake serves not only as a temporary relocation site during floods, but also as evidence of the interconnectedness of their lives, employment opportunities and the dynamic relationship they have with their neighbourhood.

An unwavering commitment to disaster relief is evident from the support provided to the community by the local government, central government, and various social organisations. This collective effort underscores the gravity of the situation posed by the continuous and cyclical flooding of Lake Tempe, which is expressly classified as a disaster. This classification is not just a semantic label, but is reinforced by the substantial care and support provided by government and social organisations. This collaborative response aligns with established disaster criteria (Alexander, 2017)(Walker et al., 2010). A coordinated approach to disaster relief not only recognises the ongoing challenges faced by communities, but also signals a shared commitment to mitigating these recurring environmental impacts.

Despite facing flooding that often reaches one metre above the floor of their stilt houses, residents consistently choose to remain in their homes, driven by a variety of reasons. Aside from the practical reasons of

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protecting their homes and possessions from flood damage, this decision is also informed by a unique perspective. Residents consider this period as a welcome respite from their role as farmers, allowing them to earn unexpected profits. During the floods, they conducted fishing activities in the waters around their homes, and simultaneously received disaster relief in the form of basic food supplies. This combination of protective measures, smart measures and communal support changed the way residents viewed flooding. Instead of viewing floods as a disaster, the community sees floods as an opportunity to gain unexpected benefits, illustrating the adaptive mindset and resilience that has been deeply embedded in their daily lives.

Resilience of the Tempe Lake Community

Community resilience, particularly in the context of recurrent flooding, is a multi-faceted concept that includes financial stability and coping mechanisms. In the face of annual flood events, communities in the region show remarkable resilience in dealing with the challenges posed by the natural event of flooding in the lake. Their proficiency in spotting early signs of impending floods, often with forecasts 1-3 days ahead, is testament to their deep understanding of the local environment. This knowledge, firmly rooted in traditional wisdom passed down through generations, contributes to their ability to predict and prepare for floods. Surprisingly, more than 90 per cent of community members have a strong understanding of the flood phenomenon, derived from their decades of experience and various channels of information such as familial ties to upstream areas, electronic media and social networks. This collective awareness reflects a commendable level of resilience in the face of hardships brought about by recurrent flooding. In particular, communities exhibit a unique form of local wisdom, which is based on their understanding of climate and flood dynamics. However, despite its significance, this local knowledge has not been properly recognized and rewarded by the government, The government's indifference in this regard underscores the need for a more inclusive approach that integrates local knowledge into broader disaster management strategies (McCarthy & Obidzinski, 2017; Seneviratne et al., 2012; Terpstra & Gutteling, 2008)

The communities living around Tempe Lake have shown remarkable ability in dealing with the challenges posed by the alternating floods and droughts. Facing these natural phenomena as a routine part of their lives, the communities have developed innovative methods to overcome the difficulties. The annual floods, now an integral part of their lives, have established a prominent social resilience (Asti, 2012; Nguyen & James, 2013; Utami et al., 2017). In addition, most people in the lakeside communities belong to the poor, who often have no other options. Despite their economic limitations, communities

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around Tempe Lake demonstrate a commendable ability to adapt and survive in the face of recurrent floods and droughts (Musdah & Husein, 2014; van Dillen, 2003)

Recurrent flooding in Lake Tempe offers a different perspective, where its impacts do not inherently cause social vulnerability. This resilience stems from the integration of flooding as a routine aspect of annual life in this region. In contrast to sporadic flooding events elsewhere, residents here have adjusted to the inevitability of annual flooding and have established robust coping mechanisms. Moreover, flooding in Lake Tempe, if managed with foresight, goes beyond being a source of misery and turns into a potential source of social, economic and environmental benefits. These floods can be moments that foster social cohesion, provide temporary respite and relief, and hold the potential to drive economic growth while maintaining the balance of the local ecosystem. .(Asti, 2016; Hapsoro & Buchori, 2015)

The resilience shown by Tempe Lake communities is multi-faceted, seen from various aspects such as the length of time living around Tempe Lake, income sources, understanding of disaster causes and phenomena, and disaster management strategies. Faced with recurrent flooding, a socio-ecological disruption, these communities demonstrate adaptability through reorganisation, development and innovation, taking advantage of existing opportunities . (Folke, 2003a; Naing et al., 2009). This adaptability takes various forms, which collectively contribute to the overall resilience of the community. An important factor that strengthens their resilience lies in their confidence to gain access to basic needs such as food, income, healthcare, safe evacuation routes during floods, and post-flood recovery initiatives, while protecting their homes from the adverse impacts of significant flood events (Danianti & Sariffuddin, 2015; Rasmikayati et al., 2015).

CONCLUSION

The resilient communities around Tempe Lake have exemplified a harmonious blend of tradition and innovation, enabling not only survival but also prosperity. The strategic elevation of their houses demonstrates their adaptability to dynamic water levels, creating structures that are resilient and resistant to flooding. Local government support, particularly through bamboo walkways and initiatives such as sampan boats for mobility, reflects a commitment to improving accessibility and promoting sustainable practices. The provision of resources and support for agriculture and fisheries ensures shared prosperity and community wellbeing. Despite alternative opportunities, the people of Tempe Lake choose to remain, attracted by the intrinsic value of their close-knit community and abundant resources for livelihoods. This valuable knowledge from Tempe Lake can

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serve as a reference for disaster management agencies to formulate more effective work plans that are tailored to the needs and capabilities of the community. Going forward, policies should prioritise sustainable practices, community engagement and infrastructure improvements to further enhance the resilience of Tempe Lake communities and other areas facing environmental challenge.

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