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Mangroves as Community Awareness and Perceptions of Mangroves for Climate and Disaster Resilience in Takalar and Topejawa

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Abstract: This research was conducted in Takalar Regency, Makassar, focusing on Takalar City, which has mangroves, while Topejawa Village does not. The study aims to describe the community's response to the benefits of mangroves, their impact on daily life, and how communities in mangrove-free areas perceive the potential of this ecosystem from economic, climate, and environmental perspectives. The Research adopts a mixed-methods approach structured into two key stages: observation and descriptive analysis. The results of the observation show that the community in Topejawa is aware of mangroves, presenting potential for development into a mangrove conservation zone that complements the existing tourist area. The descriptive analysis reveals that 77% of the community responded positively to the presence of mangroves, while 23% gave negative responses, indicating that, overall, the community's acceptance of mangroves is generally positive. The mapping indicates that Takalar City (Zone A) tends to view mangroves in terms of environmental benefits and climate mitigation, while Topejawa (Zone B) sees them more as an economic opportunity.

Keywords: Community Response, Mangroves, Climate change, Awareness, Perception

1. Introduction

Coastal areas in Indonesia, including Takalar, Makassar, face increasingly complex environmental challenges due to global climate change, such as rising average temperatures leading to global warming. One solution to address climate change is the planting of mangroves, as they offer various important benefits for both the environment and humans, such as carbon sequestration, coastal protection, flood control, habitat provision, microclimate regulation, pollutant filtration, and nature-based solutions for climate change mitigation and adaptation *(Kathiresan, K., & Bingham, B. L. 2001).*

The issues as existing studies on mangrove governance and coastal community resilience in Indonesia predominantly rely on quantitative survey approaches, limiting the depth of socio-ecological interpretation. Most prior research also focuses exclusively on mangrove-present regions, without incorporating comparative perspectives across areas with differing ecological conditions. In addition, previous analyses often emphasize economic aspects, while environmental and climate-related dimensions of community perception remain relatively underexplored. A preliminary review of recent literature shows that approximately 60–70% of mangrove-related community studies in Indonesia mainly focus on economic valuation, ecotourism, fisheries, and livelihood benefits, whereas only around 20–30% explicitly discuss environmental awareness, climate resilience, or disaster mitigation dimensions. Comparative studies between mangrove and non-mangrove communities are even more limited, representing less than 10% of the identified publications. Furthermore, studies examining spatial heterogeneity of social identities, such as differences between farmers and fishers in shaping conservation attitudes and participation, remain scarce. Most previous studies tend to treat coastal communities as homogeneous groups without analyzing livelihood-based differences in perception and adaptive behavior. These gaps indicate that the topic remains insufficiently explored and highlight the importance of further investigation to develop a more comprehensive understanding of community perception toward mangrove ecosystems and climate resilience in coastal Indonesia (*Arifin et al., 2024; Rahman & Fitriani, 2023; Setiawan et al., 2022).* Furthermore, despite growing concerns over mangrove degradation, limited scholarly attention has been directed toward socio-economic drivers of deforestation in South Sulawesi, particularly in Takalar, where mangroves continue to be harvested for charcoal production. These knowledge gaps restrict the development of socially inclusive and ecologically grounded strategies for mangrove governance in climate-vulnerable coastal regions. As we know that mangroves have an extraordinary ability to store carbon dioxide (CO_2), both in tree biomass and in their soil sediments. Research by Alongi (2014) states that mangroves can store 3-5 times more carbon than tropical terrestrial forests *(Alongi, D. M. 2014).*

Mangroves serve as coastal protection against erosion and storms, with their strong root systems reducing the impact of erosion and high waves (McIvor, A. L., Möller, I., & Spencer, T. 2012**).**. Mangroves can reduce wave energy by up to 66%, protecting coastal settlements and infrastructure, as well as reducing the impact of tsunamis and storms, as found in various studies (Das, S. & Vincent, J. R. 2009). The presence of mangroves can also reduce the risk of damage from extreme weather phenomena and control tidal flooding by trapping water flow and reducing the height of water entering the land (Saenger, P. 2002). Mangroves also provide ecosystem benefits by offering habitats for various species of fish, shrimp, and birds, and serve as a source of livelihood for coastal communities, demonstrating that mangroves support biodiversity and fisheries productivity *(Nagelkerken, 2008).* The Food and Agriculture Organization of the United Nations (FAO) highlights the contribution of mangroves to food security and the economy of coastal communities. Mangroves also regulate the microclimate in coastal areas by lowering air temperatures through evapotranspiration and providing stable humidity *(Hogarth, 2015*). Mangrove contributions to reducing heat effects in tropical regions are crucial. As pollutant filters, mangroves possess high biofiltration capabilities, filtering pollutants and heavy metals from seawater, improving water quality, and protecting marine ecosystems *(Kathiresan, K., & Bingham, B. L. 2001).*

In Takalar Regency, particularly in the Mappakasunggu District, there are mangrove zones around Takalar City. However, nearby areas, such as Manggarabombang District and Topejawa Village, lack mangroves, resulting in the absence of coastal protection, carbon sequestration, erosion control, fisheries habitat, and climate adaptation benefits for the people of Topejawa. This condition increases the vulnerability of the area to coastal abrasion, declining fishery productivity, and environmental degradation, thereby highlighting the urgency of

investigating mangrove ecosystems and community perceptions in the area *(Alongi, 2018; Friess et al., 2019; Romañach et al., 2018).* This research aims to describe the community's response to the benefits of mangroves in their lives. The study updates previous research by adopting a discourse analysis approach to understand the community's views on the potential of the mangrove ecosystem, including its economic, environmental, and climate change mitigation benefits. Previous studies assessed the benefits of the mangrove ecosystem in Pangkep Regency using quantitative surveys to measure public knowledge about mangrove functions in climate change mitigation, but they did not delve into social analysis or community perspectives through discourse analysis (Suryani, 2020). This study focuses specifically on areas with access to mangroves versus those without, and explores the different potential benefits of these ecosystems for local communities. Previous research in South Sulawesi also discussed the role of mangroves but did not specifically study the differences in impacts based on areas with or without mangroves (*Taufik, M, 2019)*. Earlier studies focused on direct evaluations of mangrove contributions to livelihoods but did not explore social responses or community discourse regarding the ecosystem (*Hafid, A, 2020)*.

The novelty of this study lies in its integrated mixed-methods approach, which combines direct observation, descriptive analysis, discourse analysis, and GIS-based spatial mapping to address key gaps in the literature. This research advances coastal governance scholarship by providing a comparative assessment between mangrove-present (Takalar City) and mangrove-absent (Topejawa) zones, offering cross-contextual insights that previous studies have not explored. By simultaneously examining economic, environmental, and climate-related dimensions of community perception, the study adopts a multi-dimensional analytical lens that moves beyond conventional single-aspect evaluations. The incorporation of sociolinguistic perspectives enhances theoretical depth by analyzing how livelihood identities, specifically farmers and fishers, shape environmental narratives and participation in mangrove conservation. Additionally, the use of ArcGIS for spatial visualization of community awareness contributes a practical decision-support tool for policy formulation and coastal planning. The study further situates its findings within contemporary socio-ecological pressures, particularly the ongoing extraction of mangroves for charcoal production in Takalar. This context underscores the real-world urgency and policy relevance of community-centered conservation strategies. Additionally, this research will provide an output in the form of a mapping of how the community interprets the existence of mangroves, both positively and negatively. This mapping will create a conceptual map that reflects the community's perceptions of the benefits and roles of mangroves in their environment, offering deeper insights and identifying diverse community perspectives. These findings can be translated into more inclusive and participatory policy recommendations based on active community engagement.

This research integrates various theories to understand climate change mitigation through environmental management. The Climate Change Theory explains the impact of human activities on the climate, while the Behavioral Spatial Theory examines the influence of human perception and behavior on mangrove management. The Sociolinguistic Theory highlights the role of language in shaping attitudes and community participation in conservation efforts. The Human-Environment Interaction Theory focuses on the relationship between humans and the environment, and the Community Participation Theory emphasizes the importance of community involvement in sustainable policies to mitigate the impacts of climate change.

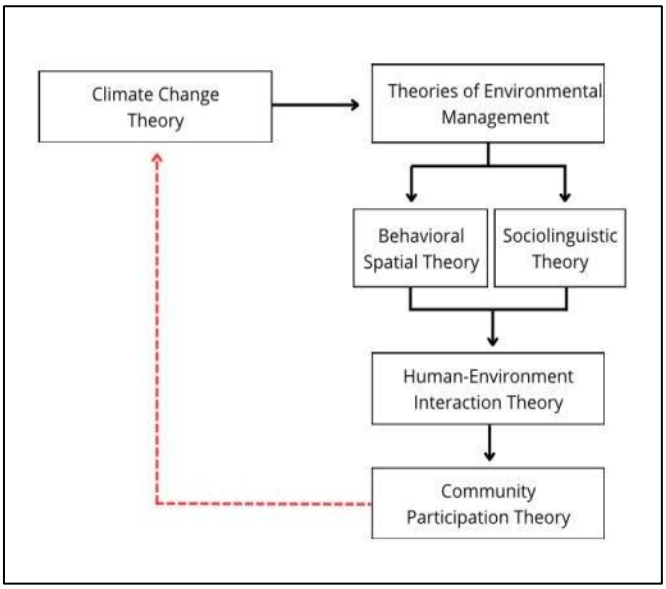


Figure 1. Theory Framework refers to a conceptual diagram that illustrates and clarifies the theories utilized in this research. It serves as a visual guide to show how the selected theoretical concepts are organized, interconnected, and applied throughout the study (2025).

The presence of mangroves has a significant impact on the lives of communities, both socially and economically, as well as in climate change mitigation. According to the Behavioral Spatial Theory, human interaction with the mangrove ecosystem is heavily influenced by their perceptions of the benefits and functions of the environment. This study analyzes the spatial behavior of coastal communities in Java in their interactions with the mangrove ecosystem. By using the Behavioral Spatial Theory approach, it is possible to illustrate how communities perceive the importance of mangroves for climate change mitigation and their adaptation to environmental damage caused by climate change *(Prasetyo, 2018*). Thus, the understanding and attitudes of the community towards mangroves can influence the sustainability of the ecosystem and contribute to climate change mitigation.

Sociolinguistic theory examines how language reflects community perceptions of the environment, including mangroves. In this context, language plays a role in shaping attitudes toward the conservation or exploitation of natural resources, suggesting that the terms used to describe mangroves reflect the social and cultural views of a particular group (Labov, 1966). Furthermore, related research indicates that social identity, constructed through language, can strengthen the mangrove conservation movement, with language supporting collective values that are positive toward the environment (Fauzie, 2018). Thus, language is not only a communication tool but also a means of shaping perceptions, influencing the community's acceptance of mangrove conservation efforts.

The Human-Environment Interaction Theory emphasizes the reciprocal relationship between humans and the environment in shaping behavior patterns and perceptions. This interaction is evident in how communities assess and respond to the presence of mangroves in their environment. Previous studies have shown that a good understanding of environmental impacts, such as oil spills, encourages communities to participate in mangrove conservation efforts (Indriawan, 2021). A similar finding was observed in a study that revealed changes in value orientation and collective identity within coastal communities, which enhanced their participation in mangrove conservation (Suryanto, 2018). This positive interaction strengthens conservation policies and the management of coastal areas in a more sustainable way, directly impacting the preservation of mangrove ecosystems and climate change mitigation.

Takalar Regency, located in Makassar, with a particular emphasis on Takalar City, an area that is home to mangrove ecosystems, in contrast to Topejawa Village, which lacks these vital coastal resources. The research aimed to explore the differences in environmental and community dynamics between regions with and without

mangroves, shedding light on how the presence or absence of these ecosystems affects local communities in terms of environmental awareness, social practices, and economic opportunities.

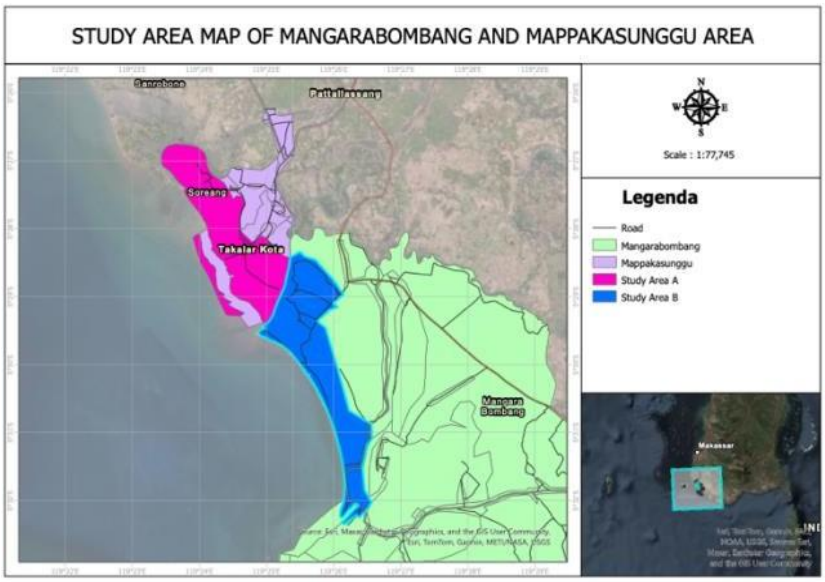


Figure 2. Study Area refers to the map illustrating the research location, in which the primary sites of this study are highlighted in pink and blue. These colored areas indicate the main focus locations analyzed throughout the research (2025).

Based on these gaps and contextual challenges, this study aims to examine how coastal communities perceive the ecological, economic, and climate-related functions of mangrove ecosystems in areas with and without mangroves, namely Takalar and Topejawa. Specifically, the research seeks to identify differences in community awareness, environmental narratives, and conservation participation between the two zones, while also analyzing how livelihood identities such as fishers and farmers influence perceptions toward mangrove management and climate resilience. Furthermore, this study aims to spatially map community perceptions and awareness using GIS-based analysis in order to provide a more comprehensive understanding of socio-ecological dynamics and support the development of participatory and community-centered coastal governance strategies.

2. Method

This This research employs a mixed methods approach by integrating field observation, questionnaires, descriptive analysis, and spatial analysis using Geographic Information Systems (GIS). The study is grounded in environmental perception theory, participatory resource management theory, and sustainable coastal management approaches. Environmental perception theory was incorporated to understand how communities interpret and value mangrove ecosystem services, particularly ecological protection, climate resilience, and socio-economic benefits *(Bennett, 2016; Bennett et al., 2017).* In addition, participatory management theory was used to assess the level of community involvement and willingness to participate in mangrove conservation and management activities *(Arnstein, 1969; Pretty, 1995).*

Field observations were conducted to identify the physical condition of mangrove ecosystems, patterns of land use, and direct interactions between communities and coastal resources. This stage also examined how mangrove presence influences environmental conditions such as coastal protection, erosion control, and fisheries support, following the sustainable coastal management framework *(Alongi, 2018; Friess et al., 2019).*

Primary data were collected through structured questionnaires and direct observation. The questionnaire applied Likert-scale responses to measure community perceptions regarding economic, environmental, and social dimensions of mangrove ecosystems. The analyzed variables included perceived economic benefits, environmental awareness, climate protection functions, resource dependency, and willingness to participate in

conservation programs. Operational definitions for each variable were developed based on previous studies on community perception and ecosystem services *(MEA, 2005; Mukherjee et al., 2014*).

Descriptive analysis was used to interpret community responses and compare perception patterns between mangrove and non-mangrove communities. Furthermore, the descriptive findings were integrated with Geographic Information Systems (GIS) to spatially visualize patterns of perception and participation across the study area. GIS analysis enabled the identification of spatial heterogeneity in community responses, particularly differences between livelihood groups such as fishers and farmers, as well as between mangrove and non-mangrove areas. This integration of social and spatial analysis provides a more comprehensive understanding of mangrove management potential based on local needs, environmental conditions, and community perceptions *(Brown & Fagerholm, 2015; Haklay, 2010).*

2.1. Observation

To gain a deeper understanding of Behavioral Spatial Theory, the research conducted a thorough spatial physical analysis, combining direct observation with an examination of physical conditions documented in relevant planning and development documents. This approach helped to identify and understand how the physical characteristics of the area influence the behavior and interactions of the local community with their environment, particularly regarding the mangrove ecosystem. The analysis involved mapping key features of the study area, including land use, infrastructure, and environmental attributes, as well as understanding the cultural and social dynamics that shape community interactions. By integrating both physical and non-physical typologies, the study aimed to capture a comprehensive view of the area's layout and its influence on human behavior and perception

2.2. Descriptive Analysis

Descriptive analysis was conducted through semi-structured interviews to understand community responses toward mangrove ecosystems, involving 30 respondents consisting of 15 respondents from mangrove zones and 15 respondents from non-mangrove zones. The study applied a discourse analysis approach, which focuses on the linguistic interpretation of participants' narratives, expressions, and meanings regarding mangrove ecosystems rather than statistical coding or frequency-based content analysis. Through this approach, the analysis explored how respondents construct perceptions of environmental benefits, climate protection, livelihoods, and conservation participation through everyday language and social narratives *(Gee, 2014; Fairclough, 2013*). The interviews were analyzed by identifying recurring themes, patterns of meaning, and differences in expressions between community groups, particularly between fishers and farmers as well as between mangrove and non-mangrove communities. This approach enabled the research to capture deeper social meanings, local interpretations, and contextual understanding of mangrove ecosystems beyond quantitative categorization *(Wodak & Meyer, 2009)*.

The study utilized three main analytical variables, namely economic, environmental, and climate variables, to clarify the types of community responses being examined and to provide operational definitions for each variable. The economic variable referred to community perceptions regarding the contribution of mangroves to livelihoods, fisheries productivity, eco-tourism opportunities, and local income generation. The environmental variable measured respondents' understanding of mangrove functions in protecting coastal ecosystems, reducing erosion, maintaining biodiversity, and improving environmental quality. Meanwhile, the climate variable focused on community awareness of the role of mangroves in climate change mitigation and adaptation, including carbon sequestration, flood reduction, coastal protection from extreme weather, and resilience to climate-related disasters. These variables were operationalized through six questionnaire items and semi-structured interview responses, which examined both perceptions and levels of participation in mangrove conservation activities. Responses were categorized into positive and negative attitudes based on cumulative scoring and interpretative discourse analysis, allowing the study to capture both quantitative tendencies and qualitative social meanings regarding mangrove ecosystems (Mukherjee et al., 2014; Bennett et al., 2017; MEA, 2005).

The data was then coded into three variables: economic, environmental, and climate, in order to analyze the community's acceptance of mangroves along the coast of Takalar. To minimize bias, the study was focused exclusively on the coastal communities of Takalar, and the data was processed using SPSS. The community responses were categorized into positive and negative, based on how they answered the questions. The maximum score possible was 12, derived from 6 questions, with each positive answer valued at 2 points and each negative answer valued at 1 point. it is possible and recommended to include the questionnaire items in the manuscript to improve methodological clarity and transparency. The six questions used in this study were designed to measure community perceptions regarding the ecological, economic, and social benefits of mangroves, as well as participation in conservation activities. Each question applied a binary response system in which positive answers were assigned 2 points and negative answers were assigned 1 point. Thus, the maximum possible score was 12 if all responses were positive, while the minimum score was 6 if all responses were negative. The questionnaire included questions such as whether mangroves protect coastal areas from abrasion and flooding, provide economic benefits, support fisheries resources, contribute to environmental sustainability and climate resilience, encourage participation in conservation activities, and receive community support for future mangrove management programs. Including these questions either in the methodology section or as an appendix will strengthen the operational explanation of variables and enhance the reproducibility of the study.

The total score calculation is as follows: The highest possible score is 12, which would be achieved if all answers were positive, while the lowest possible score is 6, which would be achieved if all answers were negative. This scoring system helps quantify and evaluate the overall response of the community towards mangrove conservation, considering both the benefits and challenges perceived by the respondents. respondents could obtain varying total scores such as 7, 8, 9, 10, or 11 because the scoring system was cumulative across the six questionnaire items. Each positive response was assigned 2 points, while each negative response received 1 point, allowing intermediate values between the minimum score of 6 and the maximum score of 12. The categorization of responses was based on the tendency of total scores, where scores ranging from 6–8 were interpreted as relatively low or negative perceptions, 9 represented moderate or neutral perceptions, and scores ranging from 10–12 indicated positive perceptions and stronger support toward mangrove conservation and management. This classification approach is commonly applied in perception-based environmental studies to quantify attitudes, awareness, and participation levels within local communities *(Likert, 1932; Creswell & Creswell, 2018).* The scoring system therefore enabled the study to systematically evaluate how respondents perceive the ecological, economic, and climate-related functions of mangroves, while also capturing variations in conservation support and community participation *(Mukherjee et al., 2014; Bennett et al., 2017)* The results from the observations and SPSS analysis will be mapped using ArcGIS to illustrate the community's attitudes towards mangroves.

This approach will provide a clear depiction of the community's views and actions regarding the presence of the mangrove ecosystem, as well as help identify patterns of perception and participation among them in the coastal areas of Takalar. The mapping will be divided into two categories: community perceptions of mangroves and community awareness of the potential of mangroves. The first category, community perceptions of mangroves, will visually represent how local populations view the role and significance of mangroves in their environment. This could include factors such as environmental protection, economic opportunities, or cultural significance. The second category, community awareness of the potential of mangroves, will map how well the community understands the broader environmental, economic, and climate-related benefits that mangroves offer, such as carbon sequestration, coastal protection, and biodiversity support. The mapping was divided into two categories, namely community perceptions of mangroves and community awareness of mangrove potential, because these two aspects represent different dimensions of human–environment interaction. Community perception refers to how respondents assess the benefits and functions of mangroves, including ecological protection, economic value, and climate resilience, whereas community awareness reflects the extent to which respondents understand the importance of mangrove conservation and demonstrate willingness to participate

in management activities. This distinction is important because positive perceptions do not always correspond to high levels of awareness or active participation in conservation efforts.

The spatial distribution shown in the maps contributes significantly to the analysis by illustrating how perceptions and awareness vary across different zones and livelihood groups within the study area. Areas with higher perception scores indicate communities that experience more direct benefits from mangroves, such as fisheries support, coastal protection, and environmental services, while areas with lower scores may reflect limited interaction with mangrove ecosystems or lower dependency on coastal resources. Similarly, the awareness distribution map helps identify which communities possess stronger understanding and support for mangrove conservation, thereby revealing spatial patterns of environmental engagement and potential participation in future management programs. These findings demonstrate that community responses toward mangroves are not spatially homogeneous but are influenced by livelihood characteristics, environmental conditions, and proximity to mangrove ecosystems. Therefore, the maps do not merely visualize survey results but also provide analytical insight into the socio-spatial dynamics shaping conservation attitudes and climate resilience in the study area *(Brown & Fagerholm, 2015; Bennett et al., 2017; Mukherjee et al., 2014).* Furthermore, these explanations are more appropriate to be placed within the discussion section, as they provide interpretation and analytical elaboration of the findings, while the conclusion section should focus only on summarizing the main results of the study. By using ArcGIS, these maps will provide a detailed and spatially accurate overview of the local community's engagement and understanding of mangrove ecosystems, which can inform future conservation efforts and policy recommendations.

3. Result and Discussion

Results and discussion present the study's findings, where field observations are developed into typologies, and descriptive analyses generate the supporting graphs and maps.

3.1 Typology

The results of field observations and literature studies reveal differences in both physical and non-physical characteristics between two areas in Takalar Regency: Zone A (Mangrove Area) and Zone B (Non-Mangrove Area). The following table analyzes various factors, such as land use, environmental threats, settlement patterns, and livelihoods in both zones, to provide an understanding of how these differences affect the community's life and the management of natural resources, particularly mangroves. These distinctions are crucial in the context of managing, conserving mangrove ecosystems, and climate change mitigation efforts. Below is the table Comparative Analysis of Zone A (Mangrove) and Zone B (Non-Mangrove) in Takalar Regency.

Table 1. Typology Result

Comparative Analysis of Zone A (Mangrove) and Zone B (Non-Mangrove) in Takalar Regency			
		Zone A (Mangrove Area)	**Zone B (Non-Mangrove Area)**
Category	**Criteria**	***Mappakasunggu District, Takalar City***	***Manggarabombang District, Topejawa Village***
Physical Typology	Area Size	7.21 km²	4.48 km²
	Land Use	Conservation, Aquaculture, Settlement	Agriculture, Settlement
	Topography	Lowland with gentle slope (0-2%)	Lowland with gentle slope (0-2%)
	Soil Type	Alluvial soil with high organic content	Alluvial soil with dominant sand content
	Accessibility	Paved and unpaved roads (relatively easy access)	Paved and unpaved roads (relatively easy access)
Non-Physical Typology	Environmental Threats	Erosion, Flooding, Sedimentation	Erosion, Flooding, Sedimentation
	Population	4,838	4,275
	Population Density	671.01 people/km²	954.24 people/km²

	Livelihoods	Fishers, Aquaculture Farmers, Traders	Farmers, Traders, Agricultural Laborers
	Settlement Pattern	Clustered along coast and aquaculture ponds	`Clustered along main roads and farmland
	Social Activities	Fisher groups, Aquaculture farmer groups, Community mutual aid	Farmer groups, Community mutual aid

In the analysis using Behavioral Spatial Theory, the differences in community perceptions and behaviors towards space in Zone A (Mangrove) and Zone B (Non-Mangrove) are evident in their relationship with the coastal ecosystem. In Zone A, communities living near mangroves have a deeper understanding of the ecosystem's benefits, such as protection against erosion and climate change mitigation. Their connection to mangroves, which serve as a source of livelihood through aquaculture and fishing, encourages them to be more actively involved in mangrove conservation, as they experience the positive impacts directly in their daily lives.

In contrast, Zone B, despite facing environmental threats like erosion and flooding, has communities that are more focused on agriculture and trade. They have less direct interaction with mangroves as a protective ecosystem, leading to limited involvement in mangrove conservation efforts. The more dispersed settlement patterns in Zone B, which prioritize agricultural needs, also reflect the difference in social identity between the two zones. In Zone A, the community's social identity is more linked to mangrove preservation, whereas in Zone B, the identity is centered around agriculture, which results in lower participation in mangrove conservation. The following image (Figure 3) illustrates the results of the physical analysis and land function, further highlighting the differences between the two zones.

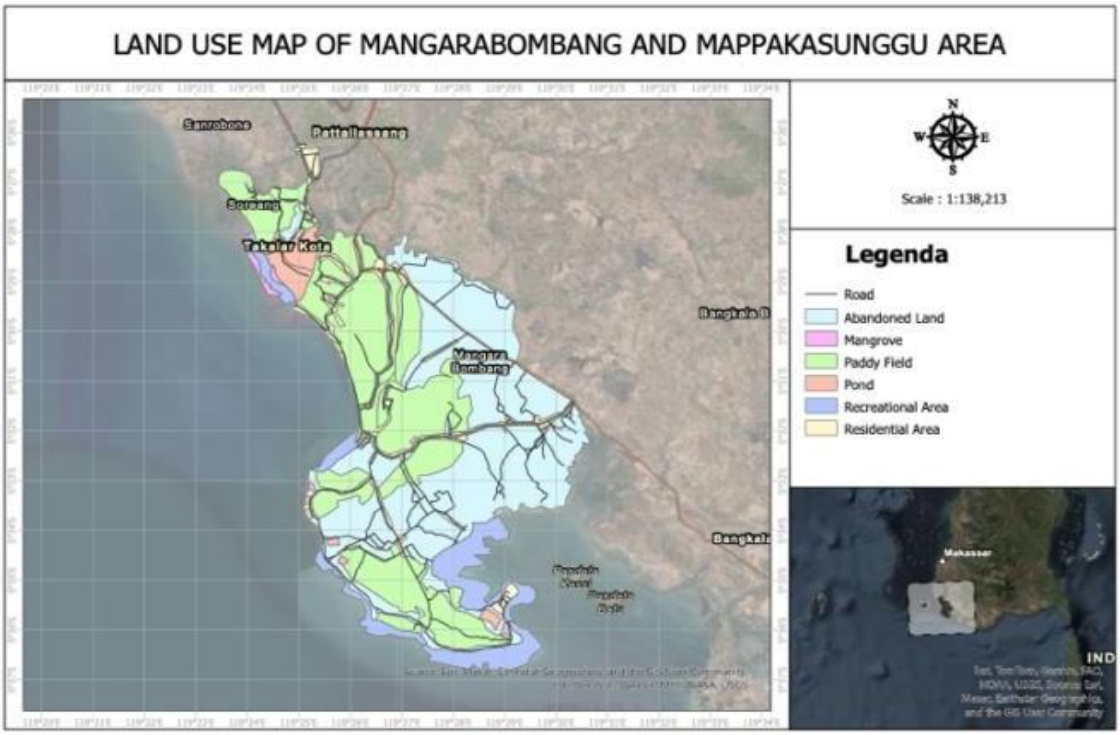
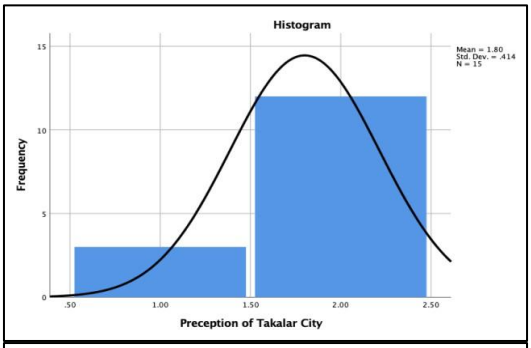


Figure 3. Land Function is a zoning map that illustrates the distribution of land-use categories within the study area. Various colors are used to represent the dominant land-use functions, providing a clear overview of how the land is utilized across the land (2025).

3.2 Community Perceptions of Mangroves

Discourse analysis reveals differences in the community's perceptions of mangroves in Zone A and Zone B. In Zone A (Mangrove), the majority of the community (12 positive, 3 negative) hold positive views towards mangroves, reflecting their understanding of the ecological and economic benefits, such as protection against erosion and resources for aquaculture. However, there are 3 individuals with negative views, which may be influenced by perceptions that mangroves do not provide immediate benefits or by challenges in their management, creating a tension between economic needs and conservation efforts. These differing opinions highlight the complexities in balancing environmental preservation with economic activities, showing that while mangroves are widely seen as beneficial, some community members may still perceive obstacles or limitations in fully embracing their conservation.



Preception of Takalar City

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Negative	3	20.0	20.0	20.0
	Positive	12	80.0	80.0	100.0
	Total	15	100.0	100.0	

Figure 4. Perception of Takalar City is a graph generated from SPSS that illustrates the comparison between positive and negative responses regarding public perceptions of Takalar City. This visualization provides an overview of how respondents evaluated various aspects of the city (2025).

Here is the mapping of the distribution of positive and negative community perception responses in Takalar City, as shown in Figure 5.

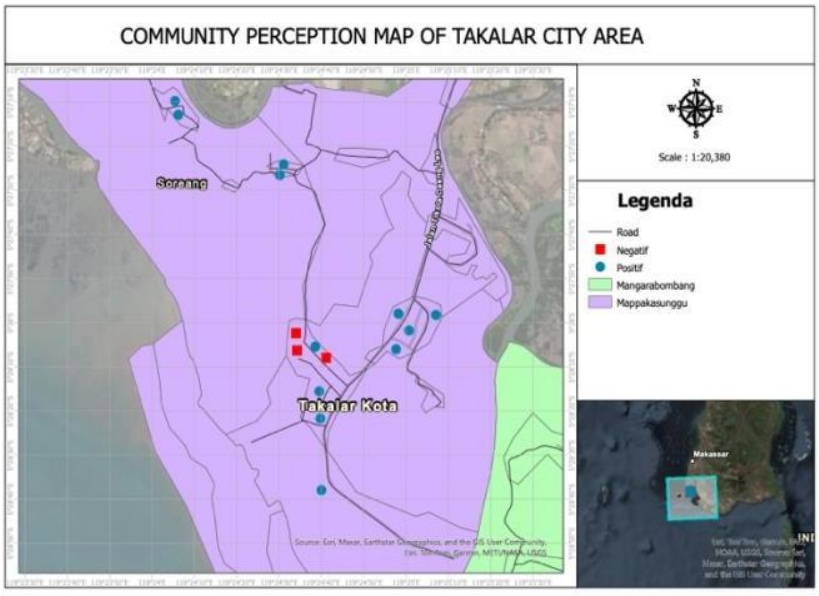
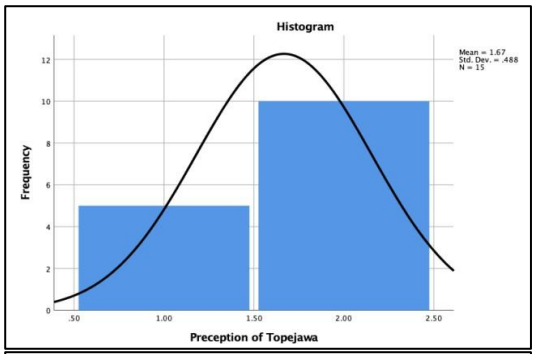


Figure 5. Community Perception of Takalar City is a visualization of the distribution of responses derived from the SPSS graph presented in Figure 4. It provides a clearer overview of how community perceptions are distributed across different categories (2025).

In Zone B (Non-Mangrove), although 10 individuals have a positive view of mangroves, there are 5 individuals with negative views, indicating a lack of knowledge or indifference towards the importance of mangroves. The discourse emerging in Zone B may reflect a disconnect with the mangrove ecosystem, as the community is more reliant on agriculture and trade. These negative views could stem from the perception that mangroves hinder development or because they do not directly experience the benefits of their presence. This disconnect suggests that the community in Zone B may not fully recognize the long-term ecological and economic advantages of mangrove ecosystems, which can affect their involvement in conservation efforts..



Preception of Topejawa

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Negative	5	33.3	33.3	33.3
	Positive	10	66.7	66.7	100.0
	Total	15	100.0	100.0	

Figure 6. Preception of Topejawa, is a graph generated from SPSS that illustrates the comparison between positive and negative responses regarding public perceptions of Topejawa City. This visualization provides an overview of how respondents evaluated various aspects of the city (2025).

Here is the mapping of the distribution of positive and negative community perception responses in Topejawa, as shown in Figure 6.

The map contributes to the analysis by spatially illustrating the distribution of community perceptions toward mangrove ecosystems across the study area. The distribution pattern indicates variations in how different communities perceive the ecological, economic, and climate-related benefits of mangroves. Areas with higher perception scores generally represent communities that have more direct interaction with mangrove ecosystems and experience tangible benefits such as coastal protection, fisheries support, and environmental sustainability. In contrast, areas with lower perception scores may indicate limited dependence on mangroves, lower environmental awareness, or reduced exposure to the ecosystem's benefits. The map therefore helps reveal that community perception is not homogeneous but influenced by spatial factors, livelihood characteristics, and proximity to mangrove areas.

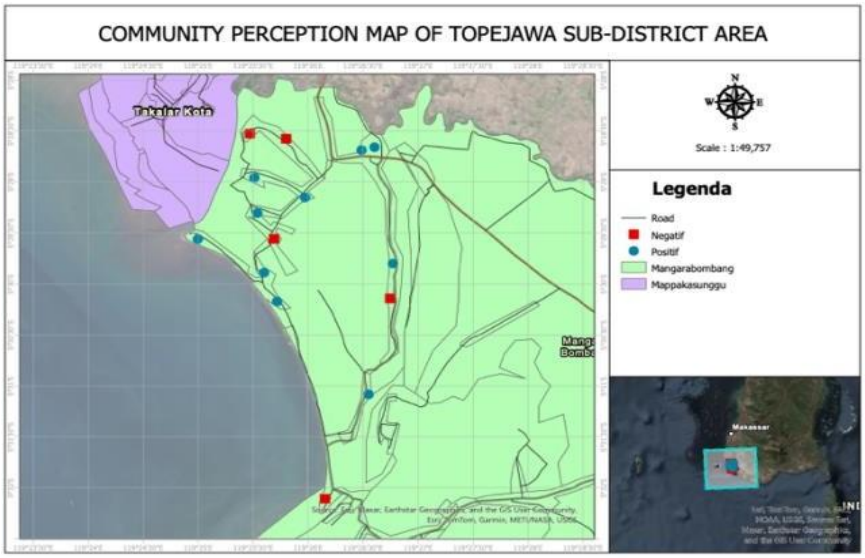


Figure 7. Community Preception Topejawa, is a visualization of the distribution of responses derived from the SPSS graph presented in Figure 6. It provides a clearer overview of how community perceptions are distributed across different categories (2025).

3.3 *Community Awareness Of The Potential Of Mangroves*

In Zone A, with the majority of responses focusing on climate and environmental factors, the community is more aware of the benefits of mangroves in terms of environmental protection and climate change mitigation. The higher percentages in the climate change (36.36%) and environmental (37.12%) categories indicate that people in this zone prioritize the ecological benefits of mangroves, such as erosion control and coastal protection, as well as their role in addressing climate change. However, awareness of the economic benefits (26.51%) is slightly lower, which may be due to the perception that the direct economic benefits of mangroves, such as aquaculture, have not been fully exploited or are not widely understood by the community. This suggests that while there is a strong appreciation for the ecological roles of mangroves, there may be untapped potential for the community to more actively engage with the economic opportunities offered by mangrove ecosystems.

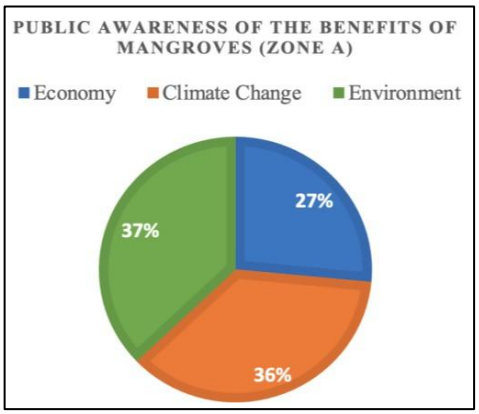


Figure 8. Distribution of Public Awareness in Takalar City refers to the distribution of community awareness regarding economic interests, climate change, and environmental concerns in relation to their knowledge of mangroves. This visualization illustrates how these different awareness dimensions are proportionally represented among respondents (2025).

Here is the detailed mapping of the distribution of public awareness levels in Takalar City, which illustrates the spatial variation of community perceptions and responses toward the presence and potential benefits of mangroves, as presented in Figure 9.

The map contributes to the analysis by spatially illustrating the distribution of community awareness regarding the importance and potential of mangrove ecosystems across the study area. The distribution pattern reflects differences in the level of understanding, environmental concern, and willingness of communities to support mangrove conservation and management activities. Areas with higher awareness scores indicate communities that possess stronger knowledge of mangrove functions, including coastal protection, climate adaptation, fisheries support, and ecosystem sustainability. Conversely, areas with lower awareness scores may reflect limited access to environmental information, weaker interaction with mangrove ecosystems, or lower participation in conservation initiatives. The map therefore demonstrates that community awareness is spatially heterogeneous and influenced by factors such as livelihood dependence, proximity to mangrove areas, and local environmental experiences.

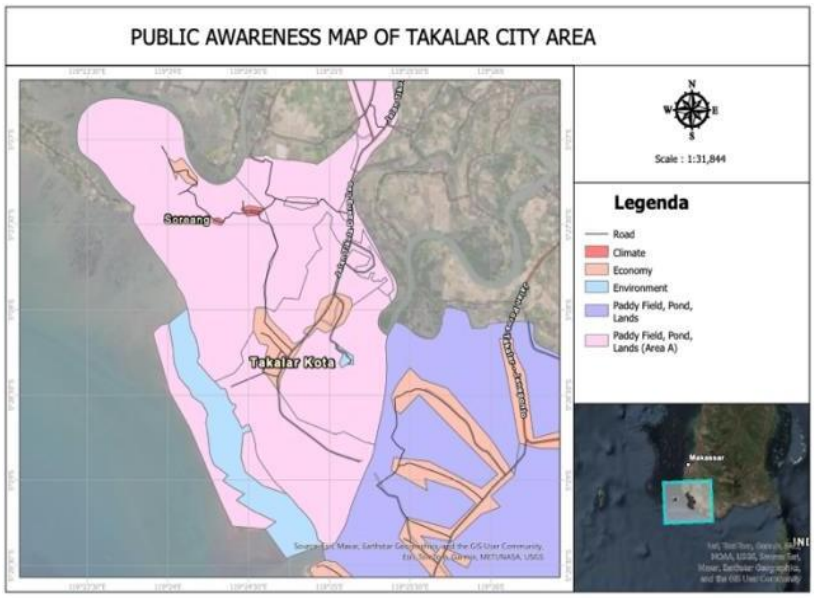


Figure 9. Public Awareness in Takalar City is a visualization of the awareness distribution shown in the graph presented in Figure 8. It provides an overview of how different awareness categories are represented among respondents (2025).

In Zone B, the dominance of responses in the economic category indicates that the community is more aware of the economic benefits of mangroves, with the highest percentage in the economic category (41%). This reflects the community's understanding in Zone B, which is more focused on the potential of mangroves as an economic resource, such as in agriculture, trade, or aquaculture activities. Meanwhile, awareness of environmental (29%) and climate change (30%) benefits is relatively lower, suggesting that they may not fully grasp the role of mangroves in mitigating climate change or protecting coastal ecosystems. This indicates a need for increased education and outreach to highlight the broader ecological importance of mangroves beyond their immediate economic value.

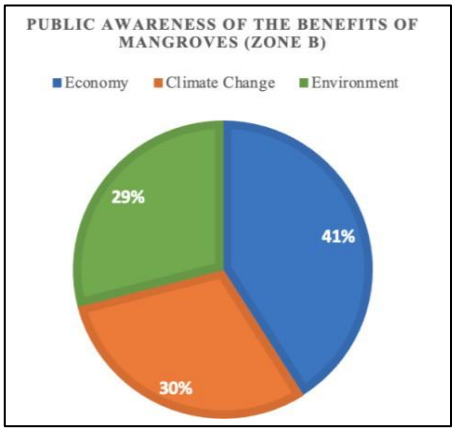


Figure 10. Distribution Public Awareness Topejawa. refers to the distribution of community awareness regarding economic interests, climate change, and environmental concerns in relation to their knowledge of mangroves. This visualization illustrates how these different awareness dimensions are proportionally represented among respondents (2025).

Here is the mapped distribution of public awareness in Topejawa, as illustrated in Figure 10, which provides a clearer spatial overview of how different awareness categories are represented across the area.

Figure 10 illustrates the spatial distribution of public awareness in Topejawa and provides a clearer understanding of how awareness levels vary across different parts of the study area. The mapped distribution contributes to the analysis by revealing spatial differences in community understanding, environmental concern, and support toward mangrove conservation. Areas categorized with higher awareness levels generally indicate communities that have stronger interactions with mangrove ecosystems and greater recognition of their ecological and climate-related functions, such as coastal protection, fisheries support, and environmental sustainability. In contrast, areas with lower awareness levels may reflect limited environmental knowledge, lower dependence on mangrove resources, or minimal involvement in conservation activities. These spatial patterns demonstrate that community awareness is influenced not only by individual perceptions but also by socio-spatial conditions, livelihood characteristics, and proximity to mangrove areas.

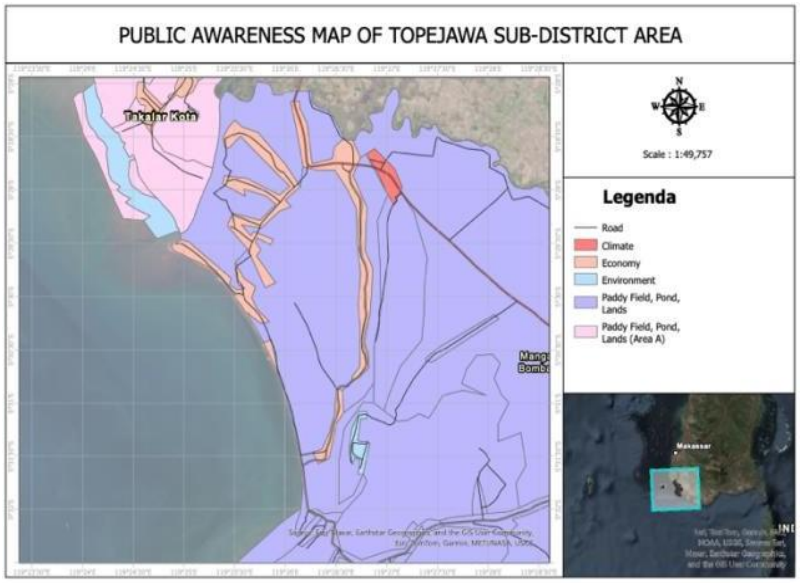


Figure 11. Public Awereness Topejawa City. refers to the distribution of community awareness regarding economic interests, climate change, and environmental concerns in relation to their knowledge of mangroves (2025).

4. Conclusion

This research provides valuable insights for coastal area management, particularly in enhancing the environmental and economic resilience of communities. In Zone A, mangrove conservation can strengthen coastal protection against erosion and the impacts of climate change, while supporting livelihoods based on aquaculture and eco-tourism. In Zone B, raising awareness about the benefits of mangroves can open new opportunities, such as mangrove crab farming or ecosystem-based tourism, contributing to the local economy. For Indonesia, these findings can serve as a reference in designing community-based climate adaptation policies, while also supporting national mangrove restoration targets. The coastal areas in this study have significant potential to be developed as integrated green economy hubs. In Zone A, strengthening mangrove eco-tourism and the processed fisheries industry could attract investment and create job opportunities. Meanwhile, in Zone B, integrating mangroves with agriculture (agro-silvofishery) can increase land productivity while preserving environmental sustainability. If managed sustainably, these areas could serve as a model for low-carbon coastal development, benefiting local communities and contributing to achieving the SDGs and Indonesia's climate commitments.

The explanation provided is more appropriate for the discussion section because it interprets the broader implications, development opportunities, and policy relevance of the findings rather than merely summarizing the research results. The conclusion section should focus only on synthesizing the key findings of the study, including differences in community perception and awareness between Zone A and Zone B, the influence of mangrove presence on environmental understanding, and the spatial distribution of conservation support. In contrast, the discussion section can elaborate on how mangrove conservation in Zone A contributes to coastal protection, erosion control, climate adaptation, fisheries productivity, and eco-tourism development, which are widely recognized ecosystem services of mangroves *(Alongi, 2018; Friess et al., 2019).* Similarly, the discussion may explain how increasing community awareness in Zone B could encourage alternative livelihood opportunities such as mangrove crab farming, ecosystem-based tourism, and agro-silvofishery systems that integrate environmental sustainability with economic productivity (FAO, 2015; Primavera et al., 2016). These interpretations are important because they connect local findings with broader sustainable coastal development agendas, including community-based climate adaptation, green economy strategies, SDGs implementation, and Indonesia's national mangrove restoration commitments under climate mitigation and low-carbon development frameworks (*Bappenas, 2021; UNEP, 2020).*

Therefore, the broader implications of mangrove conservation, including its contributions to coastal protection, climate adaptation, sustainable livelihoods, green economy development, and national restoration targets, are more appropriately discussed within the discussion section as analytical interpretations of the findings. Meanwhile, the conclusion section should remain concise and focused solely on summarizing the principal results of the study, particularly the spatial differences in community perception and awareness toward mangrove ecosystems and their implications for community-based conservation strategies

Acknowledgement

This paper has been prepared to the highest academic standards by master's students representing three collaborative study programs at Universitas Gadjah Mada (UGM). The study reflects an interdisciplinary integration of methods, perspectives, and analytical frameworks, ensuring rigorous scholarly quality. The finalized manuscript was presented at the CITIES 2025 conference hosted by Institut Teknologi Sepuluh Nopember (ITS), where it contributed to ongoing discussions on sustainable urban and coastal governance.

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