

Institutionalizing Climate Change Adaptation and Mitigation Through Education in a Small Island Context: A Case Study of South Tabukan, Sangihe Islands

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Abstract

The Sangihe Islands Regency, one of Indonesia's small and outermost island regions, has been increasingly affected by the impacts of climate change. Extreme weather events and high waves have contributed to a decline in both the quantity and quality of fish catches and agricultural yields, which are the primary sources of livelihood for many residents. However, the community's understanding of climate change, including its causes, impacts, mitigation strategies, and adaptation measures, remains limited. In response, a comprehensive community capacity-building program was initiated, focusing on education and institutionalization related to climate change mitigation and adaptation. The initiative was structured around four action clusters: medical, agricultural, science and technology, and socio-humanities. These efforts resulted in the development of environmentally friendly systems for waste disposal, agriculture, capture fisheries, and water resource management. The initiative is expected to strengthen the foundational capacities of residents in South Tabukan, Sangihe Islands Regency, enabling them to independently and sustainably mitigate and adapt to the impacts of climate change.

1. INTRODUCTION

Indonesia, as an archipelagic nation, is highly susceptible to natural disasters. This vulnerability is evidenced by data from the National Disaster Management Agency (BNPB), which reported in the Indonesian Disaster Data and Information Management Database (DIBI) that between 2010 and 2020, a total of 24,969 disaster events resulted in 5,060,778 casualties, with 4,400,809 homes affected and damage to 19,169 public facilities across the country (Adi et al., 2023; Azizah et al., 2021). Disaster risk in each region is influenced by geographical and geological characteristics, and some disasters can be predicted and mitigated.

However, many people still believe that natural disasters occur randomly and are entirely beyond human control (Azizah et al., 2021). One such type is natural disasters driven by climate change. According to the United Nations, climate change is a natural process that includes various impacts, from changes in weather patterns that threaten food security to sea level rise that increases the risk of catastrophic flooding with global consequences. The magnitude and consequences of climate change are shaped by the nature and intensity of human activities within a region.

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According to *Forest Watch Indonesia* (2021), small islands are more vulnerable to submersion than larger islands due to their limited area and capacity to withstand environmental pressures. Moreover, the lack of community awareness regarding climate change issues can further increase these risks. One such region is the Sangihe Islands Regency. Indonesia's 2022 Disaster Risk Index, published by the National Disaster Management Agency, classifies the Sangihe Islands as one of the top ten regencies with a high risk of extreme waves and abrasion (Adi et al., 2023). In addition, the Sangihe Islands are also ranked 122 out of 514 regencies in Indonesia for high risk of extreme weather disasters.

Sangihe Islands Regency, with Tahuna City as its capital, is located at latitude 125°26' – 125°41' East and longitude 3°02' – 3°47' North, within the administrative region of North Sulawesi Province. It is one of Indonesia's outermost island regencies, located near Mindanao Island in the Philippines. The regency covers a total land area of 736.98 km² and a sea area of 11,126.61 km², and consists of 105 small islands, 26 of which are inhabited, while the remaining 79 are uninhabited. The topography is predominantly characterized by hilly terrain with steep slopes and includes latosol and alluvial soil types, as well as volcanic soil due to the presence of Gunung Awu, an active volcano (Badan Pusat Statistik Kabupaten Kepulauan Sangihe, 2022).

The Sangihe Islands are located at the triple junction between the Eurasian Plate, the Maluku Sea Plate, and the Philippine Plate. They also lie within the Pacific Ring of Fire and are situated in the central part of the Sulawesi Sea. These geographical conditions make the Sangihe Islands particularly prone to disasters, especially extreme weather events associated with climate change. According to Wandu C.C. Labesi, Head of the Regional Disaster Management Agency of Sangihe Islands Regency, extreme weather is triggered by an annual cycle, often occurring in the form of La Niña storms at the end of the year (Kominfo Kabupaten Kepulauan Sangihe, 2022). Unpredictable weather patterns, storms, and high waves have contributed to reduced quantity and quality of fish catches and agricultural yields. Since the majority of the population relies on fishing and farming for their livelihoods, climate change directly affects their lives and economy.

Since 2013, Gadjah Mada University (UGM) has implemented the Fieldwork Experience – Learning for Community Empowerment (KKN-PPM) program in the Sangihe Islands. Various programs have been carried out, beginning with a focus on optimizing the cultivation and marketing of organic nutmeg, followed by community empowerment efforts in disaster mitigation, particularly for tectonic and climate-related disasters. The increasing frequency of climate change-related disasters and their impact on the livelihoods and economy of the Sangihe community have motivated further research, community service, and KKN-PPM programs since 2020, focusing on climate change mitigation and adaptation. One of these

programs involves education and the institutionalization of climate change mitigation and adaptation within the communities of Tabukan Utara District. These efforts aim to enhance community capacity for adapting to and mitigating the effects of extreme climate events and their associated environmental and ecological impacts.

2. METHOD

2.1 Data

This study used two types of data: primary and secondary. The primary data consisted of information on climate change awareness, perceived causes of disasters, traditional practices, adaptive behaviors, and disaster hazards around the South Tabukan District (including floods, landslides, abrasion and sedimentation, high waves, and extreme winds). The secondary data included: (1) Disaster Risk Index and Climate Vulnerability Reports obtained from the National Disaster Management Agency (BNPB), including the 2022 Indonesian Disaster Risk Index (IRBI), which were used to validate and contextualize local-level vulnerabilities; (2) Demographic and Environmental Statistics obtained from the Central Bureau of Statistics (BPS) of Sangihe and Forest Watch Indonesia (FWI), providing data on population distribution, land cover, and environmental stressors; and (3) Scientific and Technical References from national and international literature related to small island vulnerability, agroforestry, climate-induced disease vectors, coral reef rehabilitation (e.g., Bioreeftek methodology), and early warning systems, which were used to guide the design and implementation of interventions.

2.2 Methods

This research applied a qualitative and quantitative case study approach. Moleong (2008) defines qualitative research as a study that aims to understand the phenomena experienced by the research subjects in terms of behavior and mindset and to describe these using scientific language. A case study refers to in-depth research on an individual, group, organization, or activity program within a certain time frame to obtain a detailed description of an entity, which is then analyzed to generate theoretical insights (Abdussamad, 2021). This study used a single case study approach, focusing on the South Tabukan District in Sangihe Islands Regency. The central issue addressed is the influence of educational and institutional interventions on climate change mitigation and adaptation among local island communities.

In collecting data, we used in-depth interviews to gather detailed information and participated in community activities to make direct observations. Respondents were selected using non-probability sampling, specifically the snowball sampling technique. This method was chosen due to the relatively uncommon location, with the expectation that initial respondents would refer researchers to additional participants. Initial respondents included village heads from Bentung, Lesabe, and Malamenggu villages, who then directed us to community leaders and hamlet heads. In addition, we collected data through surveys to map data

needs and analyzed documentation containing keywords related to the Sangihe Islands, climate change, and disaster risk.

The data analysis followed the steps outlined by Miles et al. (2014), which included: (1) data collection from interviews and observations, (2) data reduction by simplifying and organizing the data, (3) data presentation using matrices to make the information more accessible, and (4) drawing conclusions and verifying the findings.

3. RESULT AND DISCUSSION

Based on the 2022 Indonesian Disaster Risk Index (IRBI), Sangihe Islands Regency is ranked 53rd among districts and cities for the multi-hazard risk index, with a score of 263.81, placing it in the high-risk category (Adi et al., 2023). The index assessment considers three main components: hazard, vulnerability, and capacity. Specifically, and based on several hazard indicators, the conditions of Sangihe Islands Regency are presented in Table 1.

Referring to Table 1, it can be seen that the disaster index for Sangihe Islands Regency is consistently high across multiple hazard categories. Several of these hazards, particularly forest and land fires, extreme waves, and extreme weather, are strongly influenced by climate change, which has already begun to impact the region. A previous study by Limbengpiah (2020) on residents of Beeng Darat Island, located in Tabukan Selatan Tengah, showed that increasingly uncertain climate conditions have reduced fish availability, as fish migrate to deeper waters. Additionally, the dry season has become longer and less predictable, and strong, sudden winds further aggravate the situation. Rising sea levels have forced local communities, especially those who rely on fishing, to become more cautious and adaptive when going to sea due to increased accident risk.

Table 1. Sangihe Islands Regency disaster index 2022 (Adi et al., 2023)

Index	Rank	Score	Risk Class
Earthquake	102	21.60	High
Tsunami	57	19.20	High
Volcanic Eruptions	8	16.00	High
Forest and Land Fires	223	24.00	High
Extreme Waves and Abrasion	10	36.00	High
Extreme Weather	122	13.60	High

This experience of unpredictable weather and climate was confirmed by each Kapitalaung—the term for village head in the local Sangir language—in the three surveyed villages. Mr. JAP Raymond Pontoh, the Kapitalaung of Malamenggu Village, stated that “the weather here is unpredictable, it can suddenly rain and then turn hot,” a sentiment echoed by Mr. Abdul Rahim of Bentung Village and Mrs. Selvia Lambanaung of Lesabe Village, whose village is located in a coastal area. Unfortunately, these changes are now perceived as natural occurrences and tend to be passively accepted by the community. The results of in-depth interviews conducted with residents of Malamenggu Village further support these observations,

with a summary of responses presented in Attachment 1.

Data from interviews show that most residents lack knowledge about climate change, its impacts, and related mitigation and adaptation efforts. This condition leads to limited public awareness, as people do not fully understand that the current challenges, ranging from unpredictable weather and crop failures to declining fish catches, are consequences of climate change. Ideally, the local community should be cooperative and informed in taking actions that minimize these impacts. The implementation of this research was carried out in collaboration with the Batch II KKN-PPM Sangihe Unit, involving 29 UGM students organized into four clusters. In response to the identified issues, the program focused on delivering education through training and institutionalization, structured across four action clusters: medical, agro-sector, science and technology, and socio-cultural.

3.1 Results of education and institutionalization in the medical cluster

Climate change can directly or indirectly affect public health. Extreme weather influences disease vectors, allowing viruses or organisms such as mosquitoes to survive longer and become more resistant (Rocklöv & Dubrow, 2020). Therefore, climate change mitigation efforts must include public health strategies at individual, community, and structural levels (Majumdar & Weber, 2023). This concern led to the development of several health-based education programs aimed at raising awareness of the importance of living a healthy and environmentally responsible lifestyle. The activities conducted (Figure 1) included: (1) socialization of clean and healthy living behavior (Perilaku Hidup Bersih dan Sehat, or PHBS) as a preventive measure to improve public knowledge and awareness; (2) medical check-ups and vitamin distribution to support preventive efforts; and (3) education on emergency medical procedures such as cardiopulmonary resuscitation (CPR) as a curative response in critical situations.



Figure 1. Medical check-up

3.2 Results of education and institutionalization in the agro cluster

For the agro cluster, we carried out a series of training and development activities focused on the agricultural,

forestry, and fisheries sectors. These activities aimed to achieve several goals: improving environmentally friendly agricultural practices, enhancing food security, promoting the planting of soil and water conservation species, and increasing both the quantity of fish caught and the adoption of environmentally responsible fishing methods.

3.2.1 Agriculture and forestry sector

The residents of Malamenggu Village have long practiced traditional shifting cultivation, a farming system passed down through generations. This method involves clearing land in designated areas by cutting and burning forests, followed by planting a variety of food crops. Typically, the land is used for two to three years (Rifqi, 2017). Mr. Engel, a leader of the Malamenggu Village farmer group, noted that not everyone in the village understands that shifting cultivation does not necessarily guarantee a successful harvest in terms of quantity or quality. In response, we promoted environmentally friendly farming practices through the socialization of agroforestry models, encouraging residents to minimize large-scale land clearing, use land more efficiently, and take ecological considerations into account (Figure 2). In addition to the socialization effort, we conducted training on producing fertilizers and bio-eco-enzymes using organic household waste such as pineapple peels and dry leaves. This approach aims to raise awareness of the harmful effects of chemical fertilizers and encourage the use of organic alternatives (Figure 3).



Figure 2 . Socialization of agroforestry agricultural

Efforts to improve food security were also carried out by utilizing local staple commodities found in the Sangihe Islands. Training sessions were held on processing raw materials into finished products such as fried fish balls, pineapple bread, and fish sauce. These activities are expected to increase the added value of local products and

improve the economic resilience of the community. From an ecological and forestry perspective, palm and gumahe trees were planted around spring water sources. The goal of this planting activity is to protect and maintain the integrity of these water sources against contamination and environmental damage caused by human activity.



Figure 3 . Compost making training

3.2.2 Fisheries sector

Lesabe Lesabe and Bentung are two coastal villages located in the South Tabukan District of the Sangihe Islands. Research indicates that the surrounding marine areas support coral reef ecosystems dominated by *Acropora* species, particularly in the reef flat and slope zones. However, these coral reefs have suffered significant degradation due to environmentally harmful fishing practices commonly used by local fishers, including the use of explosives and toxic substances. The use of compressors and gill nets in reef areas has further contributed to the destruction of coral habitats. In addition, pollutants such as household waste, mining residue, and plastic debris have negatively impacted the health and sustainability of the coral ecosystems. In response to these challenges, it is essential to implement conservation efforts, enhance environmental education for local fishers, and enforce regulations that protect marine resources to ensure the long-term sustainability of the Sangihe Islands' marine environment.

To address these issues, we introduced coral reef mapping and biographic coral reef transplant technology known as Bioreeftek. These initiatives aim to raise public awareness of the urgent need to protect marine habitats, particularly in the waters surrounding the Sangihe Islands. Coral reef mapping helps identify reef locations, monitor changes over time, and assess reef health. The information gained from this process supports communities,

researchers, and policymakers in developing more effective conservation strategies while fostering a broader public understanding of marine biodiversity conservation in the region.



Figure 4 . Bioreeftek placement

Bioreeftek (Figure 4) is a technology developed by the Center for Marine Research and Observation since 2008. The name is derived from the words “bio” for life, “reef” for coral ecosystems, and “tek” for technology. The method uses coconut shells as a substrate to support the natural development of coral planula larvae into new colonies. The structure of the coconut shell enhances habitat complexity. Its concave interior provides shelter, while the outer surface modifies current and wave patterns to create a more dynamic environment. Bioreeftek contributes to coral reef rehabilitation by supporting asexual coral propagation and restoring both structural and ecological reef functions. Through these approaches, the initiative aims to build a collective commitment to protect marine biodiversity, maintain ecosystem balance, and secure the livelihoods and well-being of local communities now and in the future.

3.3 Results of education and institutionalization in the field of science

The science and technology cluster carried out several initiatives focused on disaster management and environmental concerns. These included the development of disaster, hazard, capacity, and risk maps, the establishment of a flood early warning system, and the design and installation of waste bins. All of these efforts were guided by field surveys that identified the types of disasters commonly triggered by climate change in the region.

The development of disaster risk and capacity maps is essential for public education and raising awareness of potential hazards, especially given the geographic vulnerability of the Sangihe Islands. For example, the rainfall map of Sangihe (Attachment 2) serves as the foundational data for the development of the landslide

hazard map (Attachment 3) and the landslide evacuation map and route (Attachment 4). By promoting a better understanding of local disaster risks, these activities empower communities to respond proactively and to support government efforts in building resilient and disaster-prepared societies.

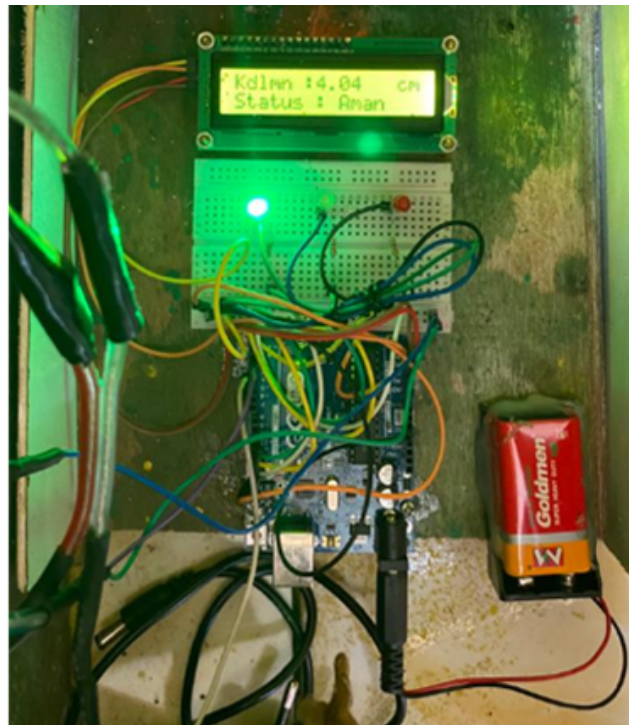


Figure 5 . Flood warning system



Figure 6 . Creation of public trash bins

One of the most frequent disasters in the three villages is flooding, generally caused by high rainfall combined with runoff from higher land areas during periods of maximum tide. In response to this condition, we developed a flood early warning system (Figure 5). This system is designed

to provide timely alerts to both the public and authorities, enabling them to take appropriate preventive and rescue measures. Through a combination of technology, data analysis, and community engagement, the system aims not only to deliver accurate early warnings but also to foster more resilient communities in the face of increasing flood threats.

In addition to disaster-related challenges, the community also faces serious environmental issues, particularly in waste management. The widespread habit of littering continues to pose risks to both human health and the environment. To address this issue, the team developed a policy brief on waste management and provided trash bins for community use, as shown in Figure 6. These interventions were accompanied by educational sessions and community counseling on waste management, aimed at raising public awareness of the importance of proper waste disposal practices.

3.4 Educational and institutionalization outcomes in the socio-cultural field

"People are starting to realize climate change, but there is little action" is the title of an article by Arif (2023), which discusses the findings of a study conducted by Yale University's Climate Change Communication Centre in collaboration with Development Dialogue Asia and Katar Indonesia. The study revealed that although most Indonesians have limited knowledge about climate change, many feel a sense of responsibility to prevent environmental degradation for the benefit of future generations. However, only a small proportion of the population has taken concrete actions or actively contributed to solving the issue.

This finding is consistent with the results of a study by Ariestya et al. (2022), which showed that Generation Z (Gen Z) in Indonesia is still reluctant to engage in concrete efforts to address climate change, despite having a relatively high level of cognitive awareness. In fact, Gen Z and future generations are among those most vulnerable to the severe consequences of climate change, especially if global temperatures increase by 2°C or more between 2040 and 2050 due to a lack of comprehensive and large-scale interventions. Therefore, community activation and empowerment in climate change adaptation and mitigation are essential for overcoming the current lack of tangible contributions in Indonesia.

In response to these conditions, several strategic programs and training initiatives have been developed, focusing on two main areas: education and community institutionalization. These efforts aim to disseminate information, foster community participation, and strengthen the capacity of local communities to independently and sustainably adapt to and mitigate the impacts of climate change.

3.4.1 Climate change mitigation and adaptation education

The process began with the socialization and establishment of the Climate Village Program working group, followed by efforts to raise awareness about the

conditions and impacts of climate change, particularly on small islands such as Sangihe. These efforts also addressed everyday habits and agricultural and fishing practices that contribute to climate change. In addition, a waste management system was implemented as part of a comprehensive approach to tackling these challenges and achieving broader objectives related to climate change mitigation and adaptation on small islands.



Figure 7 . Climate change education for church children

In addition to engaging rural communities at large, this research activity specifically targeted key segments of the population that play a critical role in the context of climate change, namely children and youth. The program disseminated information and promoted climate change adaptation and mitigation initiatives in elementary and junior high schools. It aimed to instill a strong foundational understanding and a sense of urgency among younger generations. It is hoped that this early engagement will empower them to contribute meaningfully to addressing climate change, which poses a serious threat to their future (Figure 7).

3.4.2 Institutionalization of climate change mitigation and adaptation

Community institutionalization in the context of climate change mitigation and adaptation has been realized through the establishment of a Climate Village Program Working Group, known as the Proklm Working Group. The formation of this group serves as a catalyst for increasing local awareness of the importance of understanding climate change impacts and for encouraging the adjustment of daily activities to support adaptation and mitigation efforts.

The Proklm Working Group implements a variety of initiatives in each village, including the revitalization of tourism areas, reforestation activities, the installation of evacuation route signage, and training programs on the theoretical impacts of climate change. The group has been formally incorporated into the village's organizational structure and operates under the authority of the Kapitalaung (village head). It has a clear organizational framework, with defined roles and responsibilities, and

Table 2 . Planning activities of Proklim Working Group

Short-Term (1 year)	Medium-Term (1–3 years)	Long-Term (3–5+ years)
Awareness & Immediate Action	Environmental Rehabilitation & Livelihoods	Policy Integration & Sustainability
<ul style="list-style-type: none"> • Community awareness campaigns on climate change and daily habits • School-based climate education (eco-clubs, workshops, competitions) • Distribution of waste bins and promotion of waste sorting • Installation of evacuation route signage • Basic emergency preparedness and first aid training • Formation and structuring of the Proklim Working Group 	<ul style="list-style-type: none"> • Reforestation and mangrove planting • Revitalization of eco-tourism areas • Training on climate-smart agriculture and fishing practices • Promotion of sustainable livelihoods (e.g., eco-friendly crafts, tourism) • Installation of rainwater harvesting systems • Development of small-scale waste management infrastructure 	<ul style="list-style-type: none"> • Integration of Proklim into village development planning • Creation of a Climate Resilience Roadmap • Establishment of a local climate knowledge and information center • Cross-island collaboration and knowledge exchange • Implementation of a monitoring and evaluation system

structured short-, medium-, and long-term programs (Table 2). As of this year, the group has also secured official financial support from village funds to implement its activities.

4. CONCLUSION

The findings of this study underscore the acute vulnerability of Sangihe Islands Regency to climate-induced hazards, including extreme weather events, coastal erosion, reduced agricultural productivity, and declining fishery yields. These conditions are further exacerbated by the region's geophysical characteristics as a small, outermost island group. Despite the intensity of these climate-related threats, community awareness and institutional capacity remain significantly limited. This research highlights the critical need for an integrated, multidimensional strategy for climate change adaptation and mitigation tailored to the socio-ecological context of small islands.

The structured implementation of education and institutionalization programs, organized into four thematic clusters—medical, agro, science and technology, and socio-cultural—has proven effective in addressing both cognitive and structural gaps in the community's climate resilience. Technically, the interventions included the following.

- **Medical cluster**
Promotion of preventive health behavior through PHBS (Clean and Healthy Living Behavior) education, basic medical check-ups, and emergency preparedness training to strengthen individual and collective health resilience under climate stressors.
- **Agro cluster**
Introduction of agroforestry techniques and organic fertilizer production to reduce deforestation and dependence on chemical inputs, along with training in value-added processing of local commodities to enhance food security and economic adaptation. In the fisheries sector, coral reef restoration using Bioreeftek technology was implemented to

rehabilitate marine ecosystems damaged by harmful fishing practices.

- **Science and technology cluster**
Development of hazard, capacity, and evacuation route maps; design and implementation of an early flood warning system based on local hydro-meteorological data; and a waste management system that included the production and strategic placement of trash bins to reduce environmental degradation.
- **Socio-cultural cluster**
Community segmentation strategies were used to reach both the general population and vulnerable groups such as children and youth through school-based climate literacy programs. The establishment of Proklim Working Groups institutionalized local climate action by embedding these groups into the village administrative structure under the authority of the Kapitalaung, equipping them with defined tasks and strategic short-, medium-, and long-term plans. These groups now receive official funding from village budgets, ensuring continuity and community ownership of climate programs.

The technical integration of soft approaches (education, socialization, and institutionalization) and hard approaches (infrastructure and technology), combined with participatory and place-based methodologies, has strengthened the foundational capacity for autonomous and sustainable climate action. The model demonstrated in this study not only advances localized climate governance but also provides a replicable framework for other vulnerable small islands in Indonesia and globally.

Future efforts should focus on developing data-driven decision support systems, strengthening regional partnerships, and mainstreaming climate action into broader development planning to enhance resilience at both the village (micro) and district (macro) levels.

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CONFLICT OF INTERESTS

All authors and respondents have agreed to the content and data presented in this manuscript. The authors declare no conflict of interest with any parties. Should any conflict arise in the future, full responsibility will rest with the authors.

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ATTACHMENT

Attachment 1. Interview results of Malamenggu Village community leaders

Respondents	Question	Responses
Mr. Raymond (Village Head of Malamenggu Village)	Q1	Frequent landslides and strong winds
	Q2	Perhaps due to frequent rainy weather Malamenggu is on a plateau, so many areas are steep
	Q3	Yes I have, but not quite understand
	Q4	Maybe it's more of a weather shift so the weather is erratic and not in accordance with the season
	Q5	Planting trees, reducing shifting land systems
Mrs. Ingrid (Community Element in Education)	Q1	Strong winds, heavy rain with lightning, and landslides
	Q2	The weather, because it often rains continues to affect the condition of the soil
	Q3	Once, as far as I know a kind of global warming
	Q4	I don't understand the truth, but maybe a long drought equals too hot temperatures
	Q5	Plant trees, do not litter
Mr. Sem (Community Element in Education)	Q1	Landslides and storms (heavy rain and strong winds)
	Q2	I don't know the truth, but the forecast may be because the weather here has always been like this
	Q3	Yes, I have, but it's only limited to weather shifts with uncertain climate
	Q4	I don't know about the impact, but, maybe the landslide one of the impact
	Q5	Reduced shifting field farming system, mining activities terminated
Opa Sedek (Village Elder)	Q1	Big storms, landslides
	Q2	Hmm, I'm not sure, but it's always been like this
	Q3	Only ever heard of it
	Q4	Hmm.. I don't know about that
	Q5	What is that?
Mr. Jewish (Head of Hamlet III)	Q1	Strong winds, heavy rain with lightning, and landslides
	Q2	Maybe it's because the weather here is often erratic, Malamenggu is also a Plateau so it often landslides
	Q3	Ever, but yes just heard of it
	Q4	I don't understand about it
	Q5	Maybe plant a tree but don't know too
Mr. Engel (Community Element of Farmer Group)	Q1	Landslides, strong winds with heavy rainfall
	Q2	The weather here is erratic
	Q3	Yes, I have. Just a little
	Q4	Higher rainfall is also very different weather
	Q5	Planting trees might also switch from chemical fertilizers to more environmentally friendly organic fertilizers
Mr. Muslin (Community Element of Farmer Group)	Q1	There are no natural disasters that happen too often, only violent winds and frequent rains. But residents are used to it so they don't consider it a disaster.
	Q2	Because in the archipelago area and topography that tends to be steep
	Q3	Yes, I have
	Q4	Regarding the point at which climate change occurs I don't really understand, but if the impact is on agriculture, where the growing season is erratic, which sometimes if losses can cause crop failure
	Q5	By reducing waste burning and better managing waste. Because in Sangihe, garbage is also still one of the things that need attention.
Mrs. Sari (Community Element in Health)	Q1	Most landslides
	Q2	It's because of the weather. Maybe
	Q3	Yes, but I'm not sure
	Q4	I don't know anyway
	Q5	I don't understand

Questions:

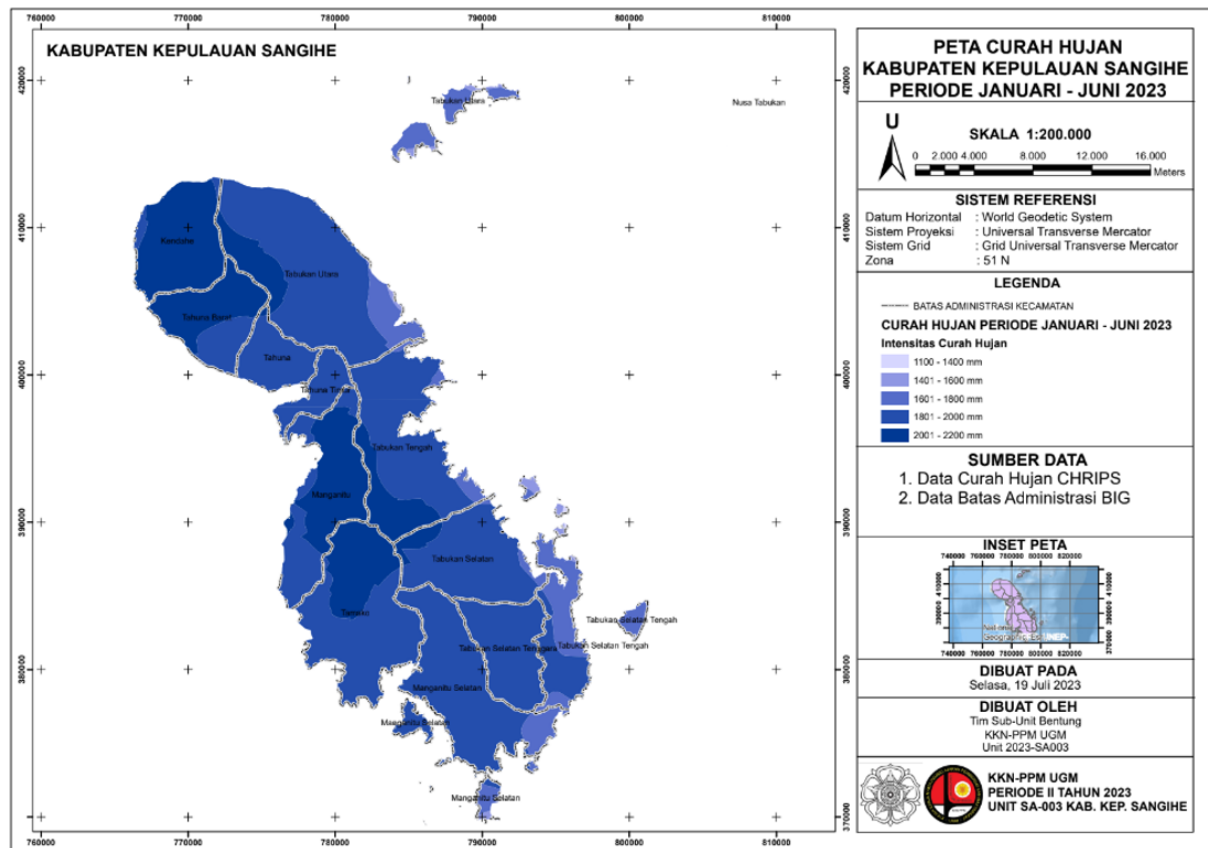
Q1: So far, what natural disasters often occur in Malamenggu Village?

Q2: According to you, what causes these natural disasters to often occur in Malamenggu Village?

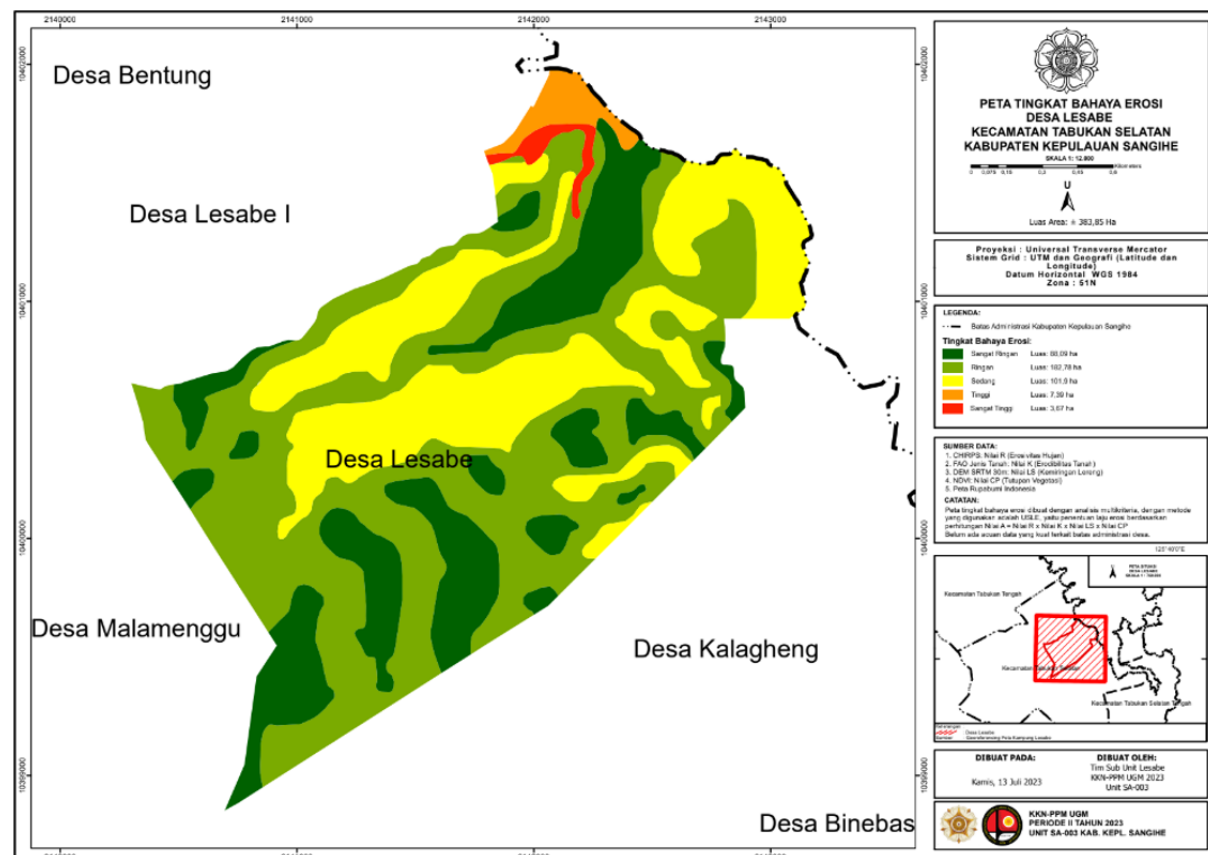
Q3: Do you know or have you heard of climate change?

Q4: Can you explain climate change and its impacts?

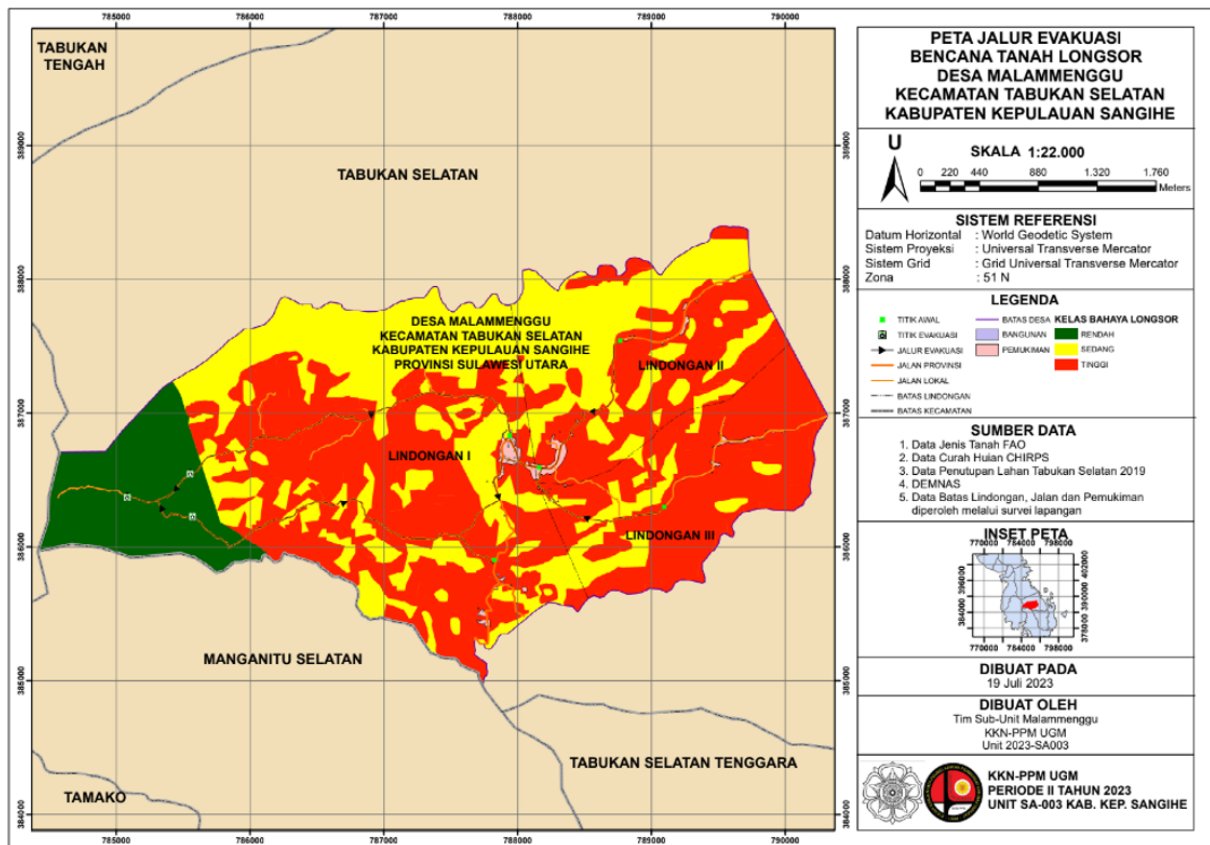
Q5: What do you think can prevent and initiate natural disasters and/or the effects of climate change?



Attachment 2. Rainfall map of Angihe Islands District for the period January – June 2023



Attachment 3. Map of landslide hazard level of Lesabe Village, South Tabukan District, Sangihe Islands Regency



Attachment 4. Map of landslide disaster evacuation route of Malamenggu Village, South Tabukan District, Sangihe Islands Regency