

Development and Institutionalization of Community Education for Climate Change Adaptation and Mitigation in Small Island Areas Based on Local Wisdom in North Tabukan, Sangihe Regency Islands

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ABSTRACT

Small islands in Indonesia are vulnerable to disasters such as earthquakes, tsunamis, floods, and landslides, one of which is the Sangihe Islands. This condition is exacerbated by climate change that is occurring and has an impact on people's economic activities, especially in the agricultural and fisheries sectors. Climate change also affects the availability of natural resources, making them unstable and vulnerable. The activities for developing and empowering adaptation and mitigation strategies in Sangihe Islands Regency aim to overcome climate change problems through developing educational models, empowerment, community capacity, and development of the disaster task force and ProKlim. This activity uses multi-actor and multi-sector collaboration methods with a participatory and persuasive bottom-up approach adapted to local wisdom. The activity was carried out in stages: developing the E-MISI learning model, developing a policy brief, institutionalizing the disaster and ProKlim task force, increasing institutional capacity, and evaluating the learning model through FGDs. The results of the activities show that 75% - 80% of the task force already know about the impacts of climate change, adaptation, mitigation actions, and the role and resolution of the task force. The ProKlim task force's capacity also increased by 40–50% over its last activity in 2021. It is necessary to develop education for the broader community by internalizing an educational model for climate change adaptation and mitigation into formal and informal education to achieve community resilience towards climate change in small islands.

Keywords: Adaptation; Community; Climate change; Education; Small island; Mitigation

1 Introduction

The Sangihe Archipelago is one of the northernmost islands of Indonesia. They are located in the province of North Sulawesi in the middle of the Sulawesi Sea, geographically precise at a latitude north of the equator, to be exact, 20°04'13" to 40°04'22". Administratively, Sangihe Islands Regency has an area of approximately 11,863.58 km², with a land area of 736.98 km² (6.2%) and a sea area of 11,126.61 km² (93.8%), which is divided into 15 districts. The Sangihe Archipelago is spread from a group of large and small islands totaling up to 105 islands, with 79 uninhabited and 26 inhabited islands [1]. The Sangihe Islands are affected by extreme ocean dynamics because they are located on one of the Eurasian micro tectonic plates and part of the Sulawesi-Philippines tectonic region complex [2]. Consequently, the Sangihe Archipelago is a highly active area of underwater volcanoes and hydrothermal activity. In addition, the disaster in Sangihe was classified as complete, especially earthquakes, followed by tsunamis, floods, and landslides.

Based on the 2019 Medium-Term Investment Program Plan (RPIJM), Sangihe Islands Regency relies on the agricultural and fisheries sectors to meet economic needs and regional development. Based on data



from the Maritime Affairs and Fisheries Service of the Sangihe Islands Regency, the potential for capturing fisheries is 34,000 tons per year, with a utilization rate of only around 24.9%. The most significant production was the flying fish (*Decapterus russelii*), 4,109.3 tons; skipjack tuna (*Katsuwonus pelamis*), 1,486.55 tons; cob krai (*Auxis thazard*), 856.3 tons; yellowfin tuna (*Thunnus albacares*) 656.05 tons; and cob como (*Euthynnus affinis*) 601.15 tonnes. From 2011 to 2014, fishery production in Sangihe Islands Regency tends to increase [3]. On the other hand, Sangihe relies on rice procurement from the government and the private sector to meet the needs of its people. Local rice production still does not meet future availability coupled with the rapidly increasing population growth rate, which impacts people's demand for rice.

Meteorologically, Sangihe Islands Regency is classified as extreme because dynamic sea conditions heavily influence it. Projected climate change data indicates that the Sangihe Islands area is affected by erratic climate change and dynamic changes in weather patterns. Changes in wind patterns and salinity affect chlorophyll concentrations and impact decreasing marine capture fisheries production. The potential of marine resources will also reduce and become vulnerable due to the threat of global warming [4]-[7]. Climate change also contributes to a decrease in lowland rice production and threatens Sangihe's food security. It resulted in the economy of farmers and fishermen being unstable and vulnerable. Typhoons and storms are also becoming more frequent, causing floods and landslides that threaten the people of Sangihe [8]. North Tabukan District, Sangihe, is one of the areas affected by climate change. On the other hand, the people in North Tabukan are still not fully aware of climate change, and there is low awareness among children and youth.

Solutions are needed to overcome problems due to the impact of climate change in the Sangihe Islands Regency, namely through climate change adaptation and mitigation strategies [9]. Improving the resilience system in society is urgently needed to reduce the risk of climate change hazards. Adaptation strategy is adjusting people's social and life to the negative impacts of climate change. Adaptation is based on four focuses, namely: (1) ecosystem adaptation, (2) knowledge, analysis, and networking, (3) world adaptation science programs, and (4) financial adaptation. Mitigation strategies are actions to reduce and prevent the risk of loss of life and property through structural (building infrastructure to protect the impact of disasters) and non-structural (socialization and education to improve understanding and capacity of the community in preparing and responding to disasters) approaches. Communities must be able to carry out climate change adaptation and mitigation practices to improve their quality of life (QoL) regarding disaster knowledge and daily practices in community life. Based on the explanation above, a climate change adaptation and mitigation strategy are needed in the Sangihe Islands Regency community. Adaptation and mitigation education directly rooted in the community must be carried out based on local wisdom passed down from generation to generation. It is also necessary to have a binding institution to carry out efforts to adapt and mitigate climate change sustainably. Community service focuses on developing educational models, empowering and increasing community capacity, and institutionalizing education into village development programs.

2 Research Methodology

Activities to develop and empower climate change adaptation and mitigation strategies for communities in the Sangihe Islands Regency use multi-actor and multi-sector collaboration methods. Previous programs that have been implemented and evaluated, the planning and development of new programs, institutionalization in the community, and institutional capacity building result from collaborative governance by various actors. Collaborative multi-sector quadruple helix from the government sector, Non-Governmental Organizations (NGOs), KKN-PPM UGM students, and the community were also successfully achieved. PUSTEK Maritime is the driving force and developer of climate change education,

adaptation, and mitigation models, local NGOs in Sangihe Regency, namely the Sampiri Group and the Bina Sehat Foundation as a mapping adaptation and climate change mitigation by local wisdom, the North Tabuk District Government as a bridge for legalization and coordination with the community as well as the local village government, KKN students as technical implementers of the climate change adaptation and mitigation education model, as well as the community as the target for developing the educational model. The educational model of climate change adaptation and mitigation for ordinary people requires a participatory bottom-up approach to the community persuasively. This approach was chosen to build mutual trust and increase public awareness and capacity for the impact of climate change on the environment. A participatory bottom-up approach is carried out by KKN-PPM UGM students in their implementation in everyday life with the community. KKN-PPM UGM students actively work with the community to identify trends in changes in environmental conditions that have occurred due to climate change in recent years. These programs have been developed based on last year's evaluation and adjustments to Sangihe's local wisdom and community's needs.

3 Theory and Calculation

Climate change is one of the indicators of the 13th SDGs, a sustainable development agenda that all countries must implement by 2030. In achieving the 13th SDGs, education is needed to encourage people to be proactive and aware of the complex climate change issues. Furthermore, the community is invited to be more tactical in adapting and mitigating climate change through the programs it plans. Education is vital in encouraging community empowerment and development, especially in dealing with the impacts of climate change. Education related to the 13th SDGs related to climate change calls for actions to reduce gas emissions and climate change adaptation and mitigation. The level of education of its leaders directly influences the success of achieving SDGs and climate change adaptation and mitigation [10].

Adaptation and mitigation education principles can be applied in the community or formally by educational institutions in schools or colleges. Through education, it is hoped that community groups and students will gain the knowledge and skills to promote sustainable development and lifestyles [11]. Climate change adaptation and mitigation education are expected to encourage and produce leaders who can solve complex and challenging environments due to climate change. Education that the community has pursued will foster awareness and capacity of the community and institutions related to adaptation, mitigation, impact reduction, and early warning of climate change.

The concept of community-based adaptation and mitigation education is based on the three pillars of sustainable development education, namely:

- Economy, where extraordinary natural resources from fisheries and agriculture through adaptation and mitigation education in the form of farming and fishing systems, strengthening of local crop cultivation and the method of intercropping so that it becomes a source of community prosperity.
- Environment, in which environmental conditions are considered for balance and sustainability, especially in maintaining water systems and security of residence/life, with environmentally friendly regional planning and disasters, land use/agriculture systems that are appropriate to the area.
- Social, where education develops empowerment, institutions, and partnerships in disaster adaptation and mitigation without preconditions.

In 2021 a climate change adaptation and mitigation education model was developed in Sangihe Islands, including training of trainers (ToT) and outreach and training to community representatives. This educational model still needs to be developed, starting from adjusting the material to local wisdom, institutionalizing the community as the person in charge of climate change adaptation and mitigation programs, and increasing the capacity of the institutions that will be created.

4 Results and Discussion



Figure 1: *E-Misi Learning Model*

The educational model, as shown in Figure 1, was adapted and translated into several programs, namely the development of policy brief material as the basis and reference for the work program of the task force, the development of the "E-Misi" learning model from PKM activities in the form of a snake and ladder game as an effort to increase awareness of children and adolescents, and Focus Group Discussion (FGD) with the *kapitalaung* (village headman), the *Kelompok Sampiri*, Yayasan Bina Masyarakat Sehat, and the PUSTEK as a form of evaluating and developing a curriculum model for adaptation and disaster management education. Institutionalizing the community into a disaster and ProKlim task force unit (task force), including the socialization of ProKlim and the importance of the task force's presence. It ended with institutional capacity building through workshops and pre-test and post-tests of the formed task forces. In addition, the Climate Village Program (ProKlim) is a national program managed by the Ministry of Environment and Forestry to increase community involvement in implementing climate change adaptation and mitigation actions and reducing greenhouse gas emissions.



Figure 2: *ProKlim Policy Brief*

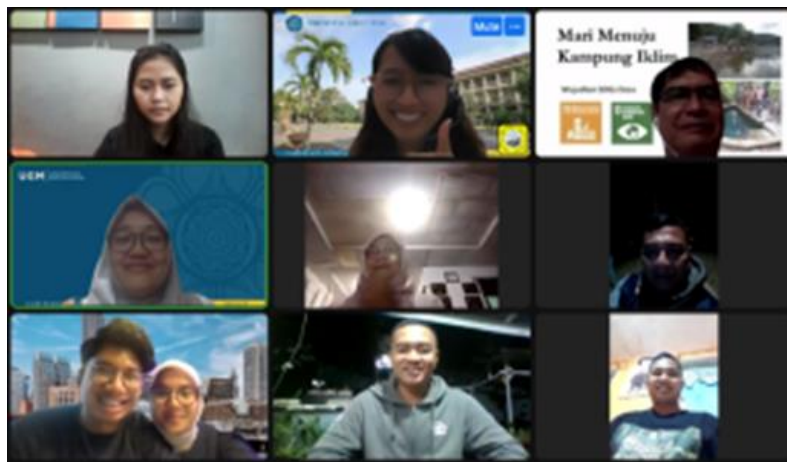


Figure 3: Focus Group Discussion via Online Video Conferencing

In practice, this program's implementation is supported by local partners, namely the Kelompok Sampiri and the Yayasan Bina Masyarakat Sehat. The role of local partners is critical. In this case, partners provide meaningful input in developing educational materials and delivery methods, especially concerning locality. In addition, this activity is also integrated into learning activities for students at Gadjah Mada University (UGM). Through a real work learning for community empowerment (KKN-PPM) scheme (Figure 2-3), students play a role in facilitating socialization, simulation, and institutionalization of the community adaptation and mitigation education model. More importantly, the village government apparatus is the main stakeholder in coordinating the realization of the institutionalization of this educational model, in which the village government legalizes the formation of a task force by ratifying the Village Decree (SK). There are three villages from North Tabukan District which authorized the SK. Those namely West Petta Village with SK *Kapitalaung* of West Petta Village number 20 of 2022 (Figure 4-5), SK *Kapitalaung* of East Petta Village number 10 of 2022, and SK *Kapitalaung* of South Petta Village number 140/01/2022 and number 140 /02/2022. Thus, the task force personnel with their primary duties and functions are mandatory to ensure the sustainability of this education program and the implementation of their activities is protected by law.

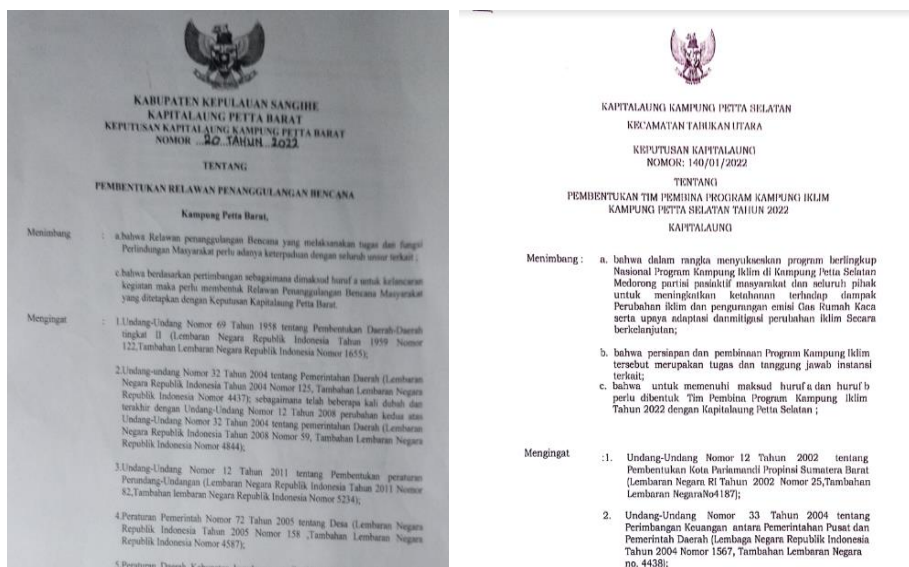


Figure 4: Petta Barat Village Law

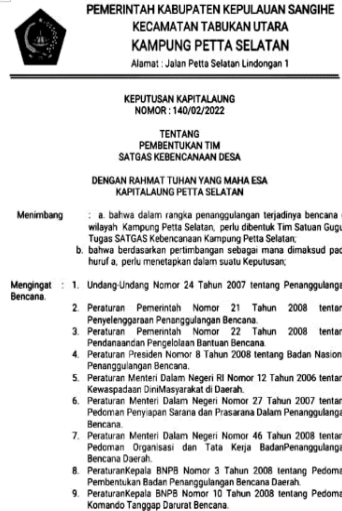
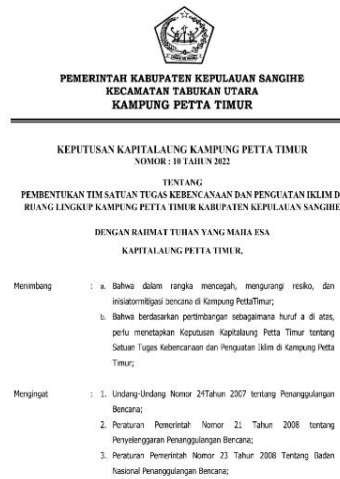


Figure 5: Petta Selatan Village Law.

The results of the pre-test and post-test of a total sample of 15 people who are representatives of the disaster and ProKlim task force from various villages say that there has been a significant increase in knowledge and awareness related to climate change after the screening before the workshop (Figure 6-8). In addition, there is an increase in knowledge of all indicators, from explaining and identifying climate change, climate impacts, adaptation assistance, and assistance according to local culture to understanding the task force's role and ProKlim goals.



Figure 6: Forming of the Task Force in Petta Selatan Village.

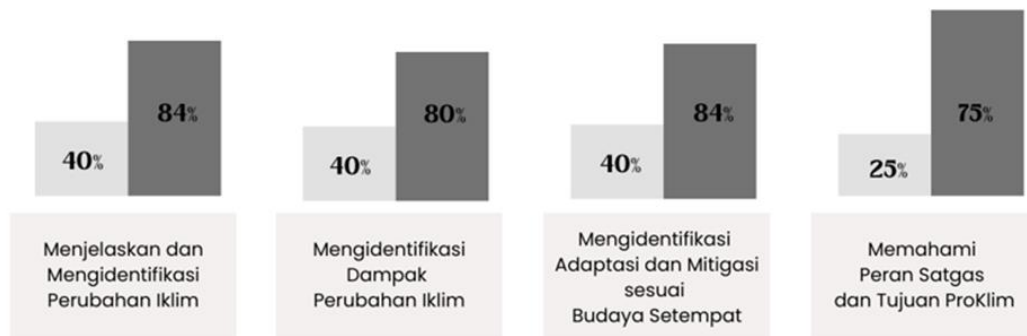


Figure 7: Results Pre-Test & Post-Test.



Figure 8: *Task Force Workshop.*

5 Conclusions

The program's success can be demonstrated through the results of the pre-test and post-test of the disaster task force and ProKlim training activities. About 75% to 80% of the task force is already aware of the implications of climate change, adaption strategies, mitigation tactics, and the task force's responsibilities. These results also show that the ProKlim task force's capacity increased by 40–50% from its activities in 2021. This training activity was recently held and aimed at people on a small island, the Sangihe Archipelago. Meanwhile, education must be extended to broader society to create a resilient community to climate change in other small islands and areas.

In this case, it means that the education model for climate change adaptation and mitigation also needs to be internalized in the public education system, formally and informally, to be more sustainable. Thus, it is necessary to develop additional materials and methods tailored to the targets, for example, fishermen communities, farmer communities, youth communities, religious communities, and students (elementary school, junior high school, and high school). In addition, the educational model for climate change adaptation and mitigation in each region must be adapted to the targets, potentials, problems, local conditions, and local wisdom to be more readily accepted and understood by the local community. In addition, achieving a climate-resilient village requires full support and commitment from all groups, namely the village government and the community, who lead the frontline in adaptation and mitigation actions.

6 Declarations

6.1 Study Limitations

Activities to develop and empower climate change adaptation and mitigation strategies for communities in the Sangihe Archipelago Regency are aimed at coastal communities on small islands so that the training is carried out according to geographical conditions, society, and local wisdom. Therefore, it is necessary to develop methods and approaches adapted to local conditions to be applied in other areas, especially with different regional characteristics. In addition, not all of the people participating in the activities in 2021 will participate in the follow-up activities 2022, thereby affecting the capacity of the community designated as the disaster task force and ProKlim.

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