The yard optimization as an adaptation strategy in combating climate change: a case study in Pendulan Hamlet, Sleman, Indonesia

E N S Alkhajar[1] and A R Luthfia[2]

[1] Department of Communication Science, Universitas Sebelas Maret, Jl. Ir. Sutami No. 36A, Kentingan, Surakarta, 57126, Indonesia
[2] Department of Public Administration, Universitas Sebelas Maret, Jl. Ir. Sutami No. 36A, Kentingan, Surakarta, 57126, Indonesia

Correspondent Author: ekanadashofa@staff.uns.ac.id

Abstract. Besides mitigation, adaptation is one of the strategies to reduce climate change impacts. This study aims to explore the yard optimization as an adaptation strategy to respond to climate change. The research used the descriptive qualitative method. The data were collected through field observation, interviews, and documentation. The results found there were three main forms of the yard optimization in combating climate change, i.e.: (1) the utilization for traditional medicinal plants to meet household needs; (2) the utilization of fish pond creation for water reservoir; and (3) the utilization for fruit and vegetables plants to enhance household nutrition and food security.

1. Introduction

Climate change is a real and huge problem threatening global life [1]. According to IPCC [2], rural areas are the ones identified as vulnerable to climate change due to lack of information and knowledge access. Nevertheless, not all rural areas in the world are blind to climate change. Some of the rural areas have good climate change literacy [3] in which these rural areas have implemented good practices in increasing climate resilience. Pendulan Hamlet is an example in Indonesia which is one of 1,212 hamlets in Sleman Regency [4]. Sleman with a 574.82 km^2-wide area itself is one of the regencies in the Special Region of Yogyakarta in addition to Kulon Progo Regency, Gunungkidul Regency, and Yogyakarta municipality [5].

Pendulan Hamlet is an interesting local case having conducted yard optimization as an adaptation strategy to respond to climate change. The adaptation itself is indeed known as one of the strategies to reduce climate change impacts [6]. Through yard optimization, the hamlet has taken some attempt of reducing the risk of climate change. It proves that rural areas contribute importantly to combat climate change. As stated by Dasgupta et al [7], more studies on practical adaptation strategies to deal with climate change in rural areas are highly needed to carry out especially to reduce research gaps in this realm. The objective of this research is to investigate the forms of yard optimization in Pendulan Hamlet as an adaptation strategy in combating climate change.

2. Materials and method

The research was carried out in Pendulan Hamlet as a case study. The hamlet with a six hectares-areawide is located at Sumberagung Village, Moyudan Subdistrict, Sleman Regency, Indonesia. Majority populations make farm as their livelihood [8]. The research focused on the yard optimization by the people as the form of adaptation to combat climate change at the local level. This study was a descriptive qualitative research. This method was appropriate to answer questions about the 'what', 'why', or 'how' of a phenomenon under investigation rather than to answer 'how much' or how many' as in quantitative method. The method was chosen because it enables researchers to get closer to the phenomena under study. In other words, the researchers act as the human instrument [9].

The three major methods employed in order to gather the primary and secondary data were field observation, interviews, and documentation. Data were collected in the form of words or narrative. A total of six competent informants were interviewed in this study. These informants were chosen based on purposeful selection [10]. The data were analyzed using an interactive model analysis. Data analysis involved such components as data collection, data reduction, data display, and conclusion drawing and verifying. Data analysis was conducted in all research procedures from data collection to research completion corresponding to the characteristics of qualitative research. The result of data analysis was then narrated descriptively [11][12].

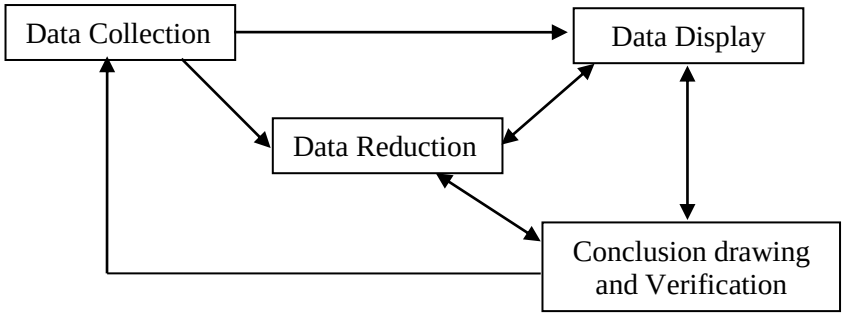

Figure 1. Interactive model of data analysis [11]

3. Results and discussion

3.1. The yard optimization as an adaptation strategy towards climate change

The topographic condition of Pendulan Hamlet can be said as good, because it is located in lowland which has never experienced drought, landslide, and flood. However, one of the potential vulnerabilities and the big risk encountered due to climate change are weather and rainfall pattern alteration. It, of course, becomes a serious threat particularly to the crop harvest because majority of the people rely on farm as their livelihood [8]. Climate change can disrupt and impact on harvest output such as lowering the crop growth thereby leading to harvest failure. Such condition encourages the population to take adaptation strategy to combat climate change, one of which is through yard optimization since 2012 until today. This hamlet has now been recognized as a climate village accordingly [8], after winning an award from the Ministry of Environment and Forestry in 2016. The forms of yard optimization can be explained further below.

3.1.1. The utilization for traditional medicinal plants to meet household needs. The people utilize their yards to plant traditional medicinal plants or called medicinal plants for family (in Indonesian called tanaman obat keluarga, TOGA). The culture of the medicinal plants are very easy and low-cost. Ginger, lemongrass, turmeric, lesser galangal, screwpine, galangal, and wild ginger are several medicinal plants cultivated there. The people usually plant them directly on the soil, or in pots or

polybags. Medicinal plants are utilized as preventive and alternative medicines to meet household needs and to protect the family's health. They can take it directly from their yard at any time when they need it without spending money. Thus, the people can save their money [13] because they already had their own living pharmacy.

The medicinal plants in the yards are free of chemicals or pesticides thereby are good for health, also improve the health resilience toward climate change. As aforementioned, climate change potentially threats the harvest output. If the harvest fails, the people' economic condition will worsen because there is no income. In such case, medicinal plants can be a rescue boat in the aspect of medicine need. In addition, several medicinal plants can also be used by households as spices for cooking purpose, thereby lowering the family's expense for spices.

Figure 2. Some medicinal plants (galangal, wild ginger) (Source: Field observation)

3.1.2. The utilization of fish ponds for water reservoir. Climate change can result in limited water supply and drought due to weather change and rainfall patterns. In relation to this, particularly to anticipate and increase resilience, another adaptation strategy is to establish fish ponds at parts of the yard. This study found most people have fish ponds. The fish species raised in the ponds are catfish, Nile tilapia, goldfish, tilapia fish, and pomfret fish. Beside farming fish, these ponds are also utilized for water reservoir or water storage to collect rainwater.

The purpose is to maintain water availability or water supply to meet water demand during low or no rainfall. Furthermore, the water in the ponds is used to watering the plants in the yard, including fruits, vegetables and tree nurseries to fulfill water requirement for growth and to prevent drought. Therefore, those practices conducted by the people are the adaptation forms of to improve water resilience against climate change threat. As stated by Rockstörm et al [14], the attempts of improving water resilience are very important as they are closely related to prosperity.

Figure 3. Fish ponds at yard (Source: Field observation)

3.1.3. Fruit and vegetable plants utilization to enhance household nutrition and food security. Optimizing the yard to raise various fruits and vegetables can be taken as an adaptation strategy to deal with climate change impacts. The people do so independently to ensure that their food security is well-maintained because climate change can lead to harvest failure. By planting fruits and vegetables, the people have an alternative food stock as another food source. They plant fruits and vegetables directly on the yard or using polybags and pots easily with low-cost, as well as medicinal plants.

The people in the study site have the principle in local language called "*nanem dhewe, hasil kanggo dewe*", which means planting and consume by themselves. This is a good principle to meet personal need and consumption. If households need fruits or vegetables for daily consumption, they can get them from the yard. The ease to obtain fruits and fresh vegetables enhance good nutrition for their health. This good practice also contributes to the economic aspect of the population as it reduces the expense to buy fruits and vegetables. Meanwhile, types of fruits and vegetables usually planted on the people's yard are papaya, jackfruit, snake fruit, mango, rambutan, orange, roseapple, guava, banana, pineapple, breadfruit, coconut, lemon, lime, cucumber tree, chili, mustard greens, aubergine, eggplant, celery, shallot, squash, water spinach, spinach, tomato, basil, and cucumber. What the people have done is an attempt of improving food resilience as the form of anticipation and response to climate change threat.

Figure 4. Examples of fruits and vegetables (Source: Field observation)

The yard optimization in Pendulan Hamlet are good practices to improve resilience toward climate change at the local level. Good communication encourage the people in the village to contribute in responding the climate change. The Chief of Hamlet plays an important role in informing many climate change issues and how to cope with it, and thus raise the awareness of taking immediate action to combat climate change improves. In addition, female farmer group also plays a significant role in encouraging the people to optimize their yard for adaptation strategy. As mentioned before, this research focuses on the adaptation strategy, particularly in yard optimization. However, mitigation

pathway has also been done in Pendulan Hamlet including waste management through the waste bank and organic fertilizer production. It, of course, becomes an interesting topic for further study.

4. Conclusion

The people in Pendulan Hamlet performed the yard optimization as a good adaptation strategy to combat climate change at the local level, hence reduce climate change impacts on rural areas. The three main forms of the yard optimization found are growing traditional medicinal plants to meet household needs, utilize fish pond for water reservoir, and cultivate fruit and vegetable plants to enhance household nutrition and food security. These strategies can be adopted by other villages or hamlets to increase resilience toward climate change by considering and adjusting with the specific characteristics of each region. In addition, the local government has an important responsibility to encourage, support and foster the continuity of these adaptation and mitigation actions.

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