Food security strategies toward flood hazards along the Cinendang river, Aceh Province

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Abstract. Singkil communities have been living along riverbanks for several centuries. They are accustomed to living near the water which has generated local wisdom in mitigating and adapting to flood hazards. This study focuses on food security in overcoming flood hazards practiced as local wisdom by the community living along the Cinendang River, Aceh Singkil. The study applied a descriptive exploration based on field observations, interviews with local communities, and in-depth interviews with community leaders and local government regarding knowledge, experiences, and the implementation of the local wisdom. The result shows that the communities practice local wisdom on structural mitigation and adaptation so that they can still supply and protect their food needs during floods. The community has taken advantage of the floating buildings namely sapao metungkhang, lampung, and bagan for these purposes. These buildings are made of logs found drifting along the river, and they are practically effective in the way that daily household and communal activities can still be carried out in both normal conditions and during the flooding. Such houses are hardly found today due to shortages of raw materials, in-progress inland transportation development, relocation of communities far from rivers, and dimmed water caused by transportation routes.

1. Introduction

Flooding is one of the disasters that frequently occurs in Indonesia, the flooding events are seen as common place occurrences when compared to other disasters such as earthquakes and tsunamis. However, their frequency and impact on the loss of life and property caused are far lower. The impact caused by disasters become worse when the community is not well prepared to face them. On the other hand, when a community has been living with such conditions for a long time, the daily habits of the community create local wisdom [1], for example, in an effort to mitigate flood hazards. Local wisdom
is considered as one way to reduce the impact of natural disasters [2]. Local wisdom related to natural disasters has been widely discussed in recent years, both in Indonesia [3]-[5] and in other countries [6]-[8]. Based on the result of these studies, it can be concluded that the success and sustainability of government intervention to reduce the risks of disaster at the community level also depends on the availability of relevant local culture, knowledge, and customary practices that can be combined with new ideas to produce innovations. Moreover, the importance of indigenous knowledge contributes not only to the success of the intervention but more importantly to its long-term sustainability. The Hyogo Framework for Action for Disaster Risk Reduction mandates the importance of considering the participation and integration of these communities in all disaster-related processes. Indigenous knowledge or local wisdom is one of the assets in helping mainstream disaster risk reduction policies and practices [9]. After the 2004 Indian Ocean Tsunami, there were two interesting success stories to review the concept of local wisdom; the Simeulue people who live off the coast of Sumatra, Indonesia as well as the Moken people who live in the Surin Islands off the coast of Thailand and Myanmar. Both use knowledge that had passed down mouth to mouth by their ancestors to survive the tsunami [9]. There are still many examples of other communities that have also used local wisdom to survive disasters and overcome difficult environmental conditions, however they have not been properly studied. Such assessments can provide many useful lessons for practitioners and policymakers to be studied on the value of indigenous knowledge for disaster risk reduction.

Local wisdom refers to methods and practices developed by a group of people from an advanced understanding of the local environment which has been formed over several generations of dwelling. This knowledge contains several other important features that differentiate it from other types of knowledge. These include those that originate within the community, maintained through informal means of dissemination, collectively owned, developed over several generations, subjected to adaptation, and are embedded in the community's way of life as a means of survival. Each region has its own local wisdom, including the people of Aceh Singkil. The Singkil community, who are used to living with nature, also have local wisdom related to flood disaster mitigation and adaptation. Mitigation can be defined as a series of efforts to reduce disaster risk through physical development as well as awareness and increased capacity to cope with hazards. Meanwhile, adaptation to natural disasters is the adjustment of natural and human systems to natural disasters that occur in order to reduce their negative impacts. Thus, in relationship to mitigation and structural adaptation, the Singkil community has local wisdom as well, however, it has not been properly studied and developed; such as the existence of floating houses that are still found along the Cinendang river. Although such structures are currently being used effectively in the effort to improve the lives of the people of Aceh Singkil, the impact of flooding in Singkil is still increasing.

In the last ten years, the intensity and quantity of floods in Singkil have increased [10]. The Cingkam community, Gunung Meriah Subdistrict, who live in the Cinendang river bank have had to face the reality of adapting to annual floods for many generations. These experiences have resulted in a form of local wisdom that mitigates and adapts to flood hazards. This paper discusses some findings from local wisdom on structural adaptation and mitigations related to food security caused by flood hazards. The discussion includes structural forms related to flood hazard mitigation and adaptation efforts, the function and development potential of these structures, and the current conditions as well as utilization of these structures.

2. Materials and methods
This research is designed as an exploratory descriptive study, which is a study that aims at solving problems based on an extensive exploration in the field of the facts of an occurrence. Thus, in this study, we have explored, explained, and described local wisdom regarding mitigation and structural adaptation to flood hazards. The data collection was carried out in March 2020. Qualitative descriptive research with an ethnographic approach is a research method that belongs to naturalistic or natural studies [11]. The detailed research design is described as follows: the initial stage was carried out by reviewing the current literature on local knowledge of flood hazards. Then, based on the results from reviewing the
literature, field observations were carried out as well as interviews with the people of Cingkam Village, Gunung Meriah District, Aceh Singkil, who live and carry out daily activities along the Cinendang river (Figure 1). In-depth interviews were conducted with traditional leaders, community leaders, and the Head of the Aceh Singkil Regional Disaster Management Agency (BPBD). The questions asked were related to the socio-cultural conditions of the Singkil community, local wisdom regarding flooding, and the direction of regional development related to disaster management. All questions were concerned mostly with structural mitigation and adaptation connected to food security.

Figure 1. The area of study is in the Gunung Meriah sub-District, Aceh Singkil (shown by a red dot), where the Cinendang River is shown by a blue line.

3. Results and discussion
The findings from observations and interviews show that there are three forms of local wisdom of structural mitigation and adaptation discussed in this article; namely sapao metungkhang, lampung, and bagan that support food security in flood hazard risks. These three structures have been used for generations by the people of Singkil.

3.1 Sapao metungkhang
Sapao metungkhang is a house on stilts that is often found along the Cinendang River (Figure 2). The building materials such as poles, floors, and walls are made of wood, while the roof is made of thatched leaves or modern materials such as metal and tiles. Vertically, the house consists of three main parts: underneath the house, the main floor, and the ceiling. These three parts can be used optimally both in normal and emergency conditions. Family activities during normal times take place on the main floor of the house. The floor height of the house is about 1-meter above the ground. There is a ladder at the front of the house that connects the yard of the house to the terrace (porch). The terrace is used as a place to welcome guests and a place to relax for the family. The main door is located in the front of the terrace...
leading into the house. The inside of the house consists of the living room, bedroom, and kitchen which is located at the very back of the building.

![Image of Sapao metungkhang house, firewood pen, and floating water pump](image)

**Figure 2.** Sapao metungkhang house (a), firewood pen (b), and a floating water pump (c).

The *sapao metungkhang* house is modified so that it can withstand the flood hazards that often occur in Singkil. The height of the house is built in accordance with the history of three historic floods that have occurred in the area. This allows for the house to be relatively safe in the event of a flood. If a flood that was higher than usual, the ceiling of the *sapao metungkhang* house could be used as an evacuation site. The room on the ceiling of the house is called *pakha* in the Singkil language. The *pakha* room is located directly under the roof. On the two sides of the front and back of the *pakha* it is equipped with small windows which can reduce the stuffiness and heat in the room. Although it is rarely inhabited, the *pakha* room is equipped with a bed and a kitchen. In the kitchen section, there is a reserve of firewood which indicates that the people of Singkil have a prepared attitude towards flood hazards. In the middle of the *pakha* floor, there are vertical doors and stairs that provide emergency access from the main part of the house to the room. Flooding is a very frequent occurrence in the Singkil area; therefore, the local community has been able to adapt to the dangers of flooding by utilizing the house as a place to take shelter. Almost all the *sapao metungkhang* houses moor their boats underneath, even though it may not be in a flood area. The boat is used as a means of transportation from home when the flood occurs. The boat is also used for fishing along the river [12]. The underneath of the house is also used to store firewood, poultry cages, and fishing equipment, such as nets and traps. Thus, some of the daily household needs are supplied from underneath the house. The experience of prolonged flooding has inspired local communities to mitigate and adapt to nature in the form of food security. Poultry sheds, firewood storage, and water pump machines are built on logs or car tires that can float at any time during a flood (Figure 2). The *sapao metungkhang* house has a fairly good prospect for development. However, several obstacles will be faced if development is carried out. The first obstacle is the change in development direction made by the government towards settlements. The local government has made efforts to build a road overland so that people could move the settlements along the road. On many occasions, efforts to relocate settlements have been carried out by the government in places far from the river, which has led to many settlements being abandoned along the river. Another obstacle that was found was the lack of raw materials to build the *sapao metungkhang* houses. The availability of wood is now increasingly scarce and expensive, whereas in the past they built houses using logs that had been washed away by the river. The government's prohibition of logging policies has also had a significant effect on the availability of drift wood in the river.
3.2 Lampung
Unlike the sapao metungkhang, which are built on the mainland along the riverbanks, lampung are floating structures that are tethered to the river bank. The lower part of the lampung is composed of logs that are tied to each other and float on the surface of the river water. The logs are tied to a wooden pole on the side of the river so that they are not carried away. The floor of the building is arranged on top of these logs. Floating houses are equipped with walls and a roof, so they are suitable for occupancy. This floating house also functions as a dock where boats can be moored for river transportation. It also functions as a floating shop that provides various needs the community such as food and beverages. Therefore, lampung, which functions as coffee shops, are always full of visitors who like to rest after traveling back and forth along the river. Lampung can also function as places of prayer, all the while still maintaining their original purpose of being a place to live for the owner.

Lampung construction is another form of local wisdom from the Singkil community in regards to flooding hazards. High rainfall in the Singkil area causes the height and flow of the Cinendang river to be very fast during the rainy season. These conditions require the people of Singkil to make adaptations in the form of building a lampung that can adjust its position to the height of the river flow. However, with the reduced use of river transportation routes, the existence of Lampung is now becoming increasingly difficult to find along the Cinendang river. Of the 3 remaining lampungs in Gunung Meriah District, the Lampung in Tanah Merah Village is the oldest and is still functioning as a coffee shop to this day.

3.3 Bagan
If the sapao metungkhang and lampung buildings function as places to live, then bagan would be described as floating buildings that are only used for daily community activities on the riverbank. The bagan consists of two parts: one side functions as a place for washing clothes or drying rice, corn, and other agricultural products during floods, and the other side of the bagan functions as a community latrine. The bagan can also be used as a place to anchor boats. The materials used for the bagan also come from logs drifting along the Cinendang river. The logs are then tied to each other with ropes and tied to pegs on the riverbank or tied to large logs with rope.

Local wisdom in mitigating and adapting to flood hazards began to be abandoned in the 1980s, as land transportation routes began to reach all corners of the Singkil area. People began to relocate their homes to higher ground areas. The relocation of this population was facilitated by the Aceh Singkil Regency Government to build habitable settlements. Although still not finding the right format for the relocation effort, the government continues to relocate residents from the riverbanks to the mainland, which produces various challenges that the community and government must face. Besides, the availability of raw materials for the construction of houses and other infrastructure, logs that drifted away during the flooding have also become increasingly difficult to obtain. Changes in livelihoods from the fisheries sector to palm oil plantations are also one of the reasons why people have migrated to higher land areas. Therefore, the possibility of re-developing these forms of local wisdom presents a challenge when viewed from the angle of their effectiveness and usefulness for the local community.

4. Conclusion
Collective awareness among the people of Singkil is one of the factors that encourages the preservation of local wisdom in adapting and mitigating flood disasters. By maintaining this local wisdom, the community has prepared themselves, especially in food security, with all possible weather anomalies that are difficult to predict. The room on the ceiling of the sapao metungkhang house is rarely inhabited, but it is equipped with a kitchen and reserved firewood that can be used for preparing food during flooding. The underside of the house is also used to store firewood, poultry cages, and fishing equipment in the river such as nets and traps. Some of the daily household needs are supplied from under the house. Poultry sheds, firewood storage, and water pump machines are built on logs or tires that can float at any time during a flood. Lampung is a floating house that also functions as a dock where boats can be moored by fishermen. Lampung also function as floating shops that provide various needs of the community.
such as food and beverages. Bagan is another floating structure that is only used for daily community activities on the riverbank. The bagan functions as a place for washing clothes or drying rice, corn, and other agricultural products during floods, and it can also function as a cooking area during a wedding ceremony while flooding occurs. The ability of the community to ensure food availability during a flood by utilizing these structures has made it easier for people in the past to survive floods than they are now. This local wisdom not only preserves traditions or customs that have been carried out for generations, but also provides several good life governances and is in harmony with nature.

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Acknowledgments
The authors express gratitude to the Indonesian Ministry of Research, Technology, and Higher Education for research funds assistance with the 'H-index grant', with the contract number: 63/UN1.2.1/PT.01.03/PNBP/2020.