EPH - International Journal Of Applied Science
ISSN (Online): 2208-2182
Volume 09 Issue 02 October 2023
DOI: 10.53555/eijas.v9i2.164

ADAPTATION OF PEOPLE LIVING IN SETTLEMENTS IN FLOOD AND TIDAL DISASTER PRONE AREAS ON THE COAST OF SEMARANG CITY, CENTRAL JAVA, INDONESIA

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Abstract
Semarang City, Central Java is an area with a variety of high economic and service activities. The coastal area faces various environmental problems such as floods, tidal floods, and land subsidence. People living in coastal areas are able to adapt in facing these environmental problems. The purpose of the study is to study how the community adapts in facing flood and tidal flood prone problems both physically and psycho-socially. The results showed a form of physical adaptation, namely through backfilling the land and elevating the building, as well as psycho-socially, namely the desire to stay at the location due to heredity and proximity to the work site.

Keywords: *physical and psycho-social adaptation, flood and tidal flood areas, Semarang City*

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INTRODUCTION

Semarang City is the capital city of Central Java Province, Indonesia has rapid economic growth, with an impact on population growth and greater space needs. This problem is almost faced by all large and medium cities in Indonesia, both provincial and regency status throughout Indonesia. The concentration of industrial locations and various services in one location that is generally found in big cities causes the attraction of working people to visit it. In the next period around the location of industrial estates new residential areas emerged as a result of the emergence of new centers of economic activity.

Semarang City as a city located on the coast has environmental problems such as floods and tidal floods that routinely occur in certain seasons. Almost the entire area of Semarang City with hilly topographic conditions in the south and lowlands in the north including areas prone to flooding. Meanwhile, in coastal areas in certain periods, tidal flooding problems arise that occur regularly. In the coastal area there is another problem that cannot be ignored, namely land subsidence that threatens the existence of all building structures that stand on it, such as roads, bridges, buildings, etc.

Based on research conducted by Mercy Corps and ARUP in 2012, Semarang City was declared as one of the cities that are resilient to climate change. In 2014, Semarang City was selected to participate in the 100 Resilient Cities program (Erlani & Nugrahandika, 2019). According to Pemkot Semarang (2016) city resilience is the capacity of individuals, communities, institutions, business actors and systems in the city, to be able to survive, adapt and develop to face chronic pressures and acute shocks.

Semarang urban challenges can be categorized into two, namely shock and stress. Shocks are dangerous events that occur suddenly such as earthquakes, landslides, and flash floods, while stress is a situation that weakens the structure of a city both daily and periodically. The form of pressure faced by Semarang City is in the form of tidal floods, land subsidence, and sea water rise. One form of stress in Semarang City is tidal flooding because this phenomenon has occurred for a long time. Semarang City Government said that tidal flooding is a chronic stress because this disaster weakens the structure of the city both daily and periodically (Pemkot Semarang, 2016). The resilience of the city is shown by the resilience of its people in facing shocks and pressures through adaptation to their environment.

RESEARCH OBJECTIVES

The purpose of the study is how to adapt people living in flood and tidal flood prone areas on the coast of Semarang City in order to survive in their respective locations both physically and psycho-socially.

RESEARCH LOCATION

The location of the study is a village affected by floods and tidal floods on the coast of Semarang City, in this case two districts directly adjacent to the Java Sea with the largest level of impact, namely Genuk District and North Semarang District. The map of the study location is shown in Figure 1.

MATERIALS AND METHODS

The material includes interviews with communities living in areas affected by floods and tidal disasters on the coast of Semarang City, covering villages in Genuk District (Terboyo Kulon, Terboyo Wetan, Trimulyo, Genuksari, and Gebangsari) and North Semarang District (Tanjungemas and Bandarharjo). The number of respondents interviewed was 55 people, consisting of 25 respondents in Genuk District and 30 respondents in North Semarang District. The number cannot be said to represent the overall condition of the population in the two sub-districts, but as a small part of the condition of the community. The interview was conducted between February 15 – 21, 2023 with the help of students taking the Coastal Sociology field course. The methods used include primary data, namely direct interviews with survivors and secondary data in the form of administrative maps, maps affected by floods and tidal floods, statistical data.

Methods used through location orientation (preliminary survey), interviews and field observations (data collection), and data processing (selection, data classification, data analysis). Respondents' answers can be multiple (more than one answer) and in some cases some do not answer.

RESULTS OF RESEARCH AND DISCUSSION

a.Geography and demographics

The area of Semarang City has changed more widely as a consequence of increasing the status of the city. Based on PP No. 16/1976, Semarang City, which originally covered an area of 107.1 km, increased to 373.70 km or more than three times the previous area. Semarang City administratively consists of 16 sub-districts and 177 kelurahan.

The population in 2014 was recorded at 1,584,068 people, so Semarang City has a population density of 4,241 people / km². In 2019 the population of Semarang City became 1,814,110 people (BPS Semarang City, 2019) meaning that the population density increased to 4,854 people / km². Sub-districts: North Semarang, Central Semarang, and Gayamsari are among the most densely populated among other sub-districts, with more than 10,000 people/km² and at the same time the most densely populated built-up areas. The development of the population that shows an increasing number can be caused by the movement from outside Semarang City into the city as a consequence of growth in the economic sector (industry and services) that increases in the Semarang City area

Based on data from North Semarang sub-district in 2022 figures (BPS Semarang City, 2022) which includes 9 urban villages with an area of 11.39 km². The population in 2021 is 123,029 people, so it has a density of 10,799 people/km².

Especially in the surveyed areas, namely Tanjungemas Village with a population of 28,546 people and Bandarharjo Village with a population of 20,391 people.
Based on Genuk District data in 2022 figures (BPS Kota Semarang, 2022) which covers 13 urban villages with an area of 27.39 km². The population in 2021 is 121,591 people, so the density is 4,680 people/km². The total population in the villages surveyed include: Terboyo Kulon (583 people), Terboyo Wetan (1,421 people), Trimulyo (3,558 people), Genuksari (17,330 people).
Based on historical analysis that settlements in the coastal area have grown rapidly since the Semarang city government policy through the Semarang City Plan 1975-2000, Semarang City RTRW (Rencana Tata Ruang Wilayah = Regional Spatial Plan) 2000-2010, and now Semarang City RTRW 2010-2030 determines the location of its industrial estates in coastal areas, namely the Wijayakusuma Industrial Estate in Tugu District in the western part of Semarang City, and the Terboyo Industrial Estate in Genuk District in the eastern part of Semarang City.
The need for land as a location for the placement of industrial areas and new residential areas is very limited, so some areas that are actually uninhabitable are forced to be used for settlement. In the period 1975-2000 in the coastal area of Semarang City was still in the form of a pond, in the following period the pond land had turned into an industrial area by reducing the pond. The need for labor that drives the industrial sector has led to the emergence of new settlements around the industrial area.

b.Distribution of floods and tidal floods in Semarang City
Flood disasters almost occur in all districts in Semarang City, but rob-prone areas only occur in coastal areas with the distribution shown in Figure 2. Some districts that are prone to flooding include: West Semarang, North Semarang, Central Semarang, Gayamsari, and Genuk. There are several sub-districts that are prone to flooding and tidal flooding, including West Semarang District, North Semarang District, Gayamsari, and Genuk. The results of research by Setiyono, et al (2022) in Genuk District in 2018-2019 the flood height on Jalan Kaligawe as a monitoring point which is the highest location of 45 cm with the impact of inundation experienced in the area south of the road which includes Genuksari, Gebangsari and Muktiharjo Lor villages. While tidal inundation occurs to the north of the road with a tidal flood height higher than 15 cm from the highest tide conditions. The impact of tidal inundation was experienced by several villages: Terboyo Kulon, Terboyo Wetan, and Trimulyo.

Figure 1. Districts in Semarang City (Pemkot Semarang, 2023)

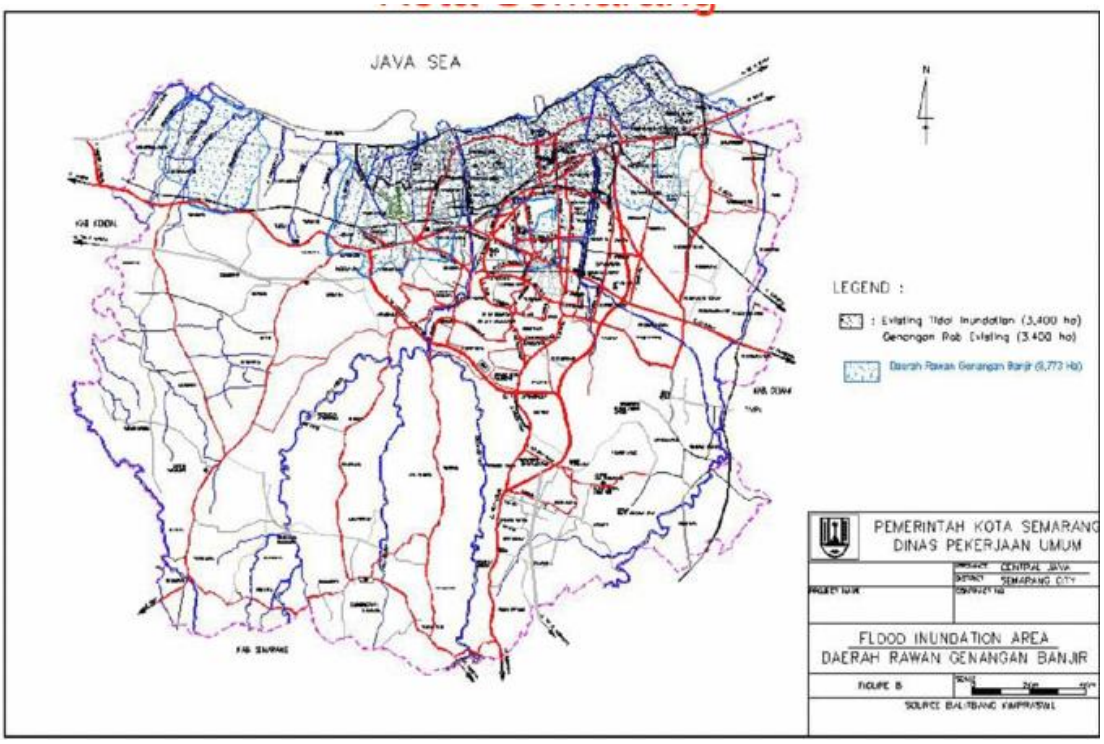

Figure 2. Areas prone to flooding and tidal flooding in Semarang City (Pemkot Semarang, 2014)

c.Conditions of education and employment level

Based on the survey of respondents' education and employment conditions in both sub-districts are shown in Table 1. In general, the education level of most respondents is below SMA (SMA = sekolah menengah atas or high school) (more than 50%). The respondents' employment status varied, among others: traders/entrepreneurs (most), non-employed/housewives, laborers, fishermen, and civil servants. This condition shows that most respondents work in the informal sector with a low level of education. According to the Pemkot Semarang (2023), Semarang City has a workforce of 1,075,827 people with 994,091 workers in 2022. The conditions are not detailed by type of work.

d.Conditions of residence

Based on the survey results of house buildings in both North Semarang and Genuk Districts, most (more than 50%) of buildings were built before 2005, and the construction of new houses is still continuing, although not as many as before 2005.

Based on the results of questions about living conditions shown in Table 2, almost all respondents in the two sub-districts have permanent residences (100%) and Most of these buildings have been elevated (77%) and the remaining 33% have not been elevated. The elevation of the building as a result of the building as a whole experiencing a process of decline due to being on a soft ground surface. According to Wardoyo, et al (2011) that the soil at the study site included soft soil whose distribution was almost along the north coast of Central Java. Some research results conducted by Prasetyo, et al (2019), Gaffara (2018), Yuwono, et al (2018) the north coast of Semarang City experienced a rate of decline between 1.5 – 15 cm / year.

Community adaptation in facing these problems is to elevate buildings in the form of backfill (inside buildings and roads) and rebuild on buildings that have come down. The community in building their houses is in the form of permanent houses, which are walled and concrete floors. While buildings that are not permanent with wood material are rare. The heavy burden of permanent housing buildings accelerates the rate of decline of the building due to being on soft ground.

e.Psycho-social condition of respondents in dealing with the environment

The survey of the psycho-social condition of respondents is related to the perception of residents in responding to their environmental conditions which often occur floods and tidal floods. Psycho-social conditions are closely related to the pattern of relationships between long-established individuals who have the same fate in the face of unfavorable situations. Table 3 shows that most respondents stayed at the location with the main reason being having lived in the location for a long time. Floods and tidal flood conditions have been considered commonplace. In the table, it can also be seen that there is a desire to change location. Respondents are generally the second generation who inherited a residential house from their respective parents. They were born, raised, and worked in an environment not far from home.

When asked why you still survive in locations that are prone to flooding and tidal flooding, then they answered in Genuk 94% for family relationship reasons and in North Semarang 46%. Most of the respondents are inheriting the residence from the father, mother, husband, wife before. They have an inner bond with the location where they live considering they were born, raised, and worked not far from that location. In the North Semarang region, 53% have links to the surrounding

jobs. In the North Semarang area, it is known to be the location of the sea port with various supporting facilities, so the reason for surviving because of work is more reasonable.
The main reason respondents stayed in the location was economic (especially financial) problems, so they could not afford to move to a new location that was free from floods and tidal disasters. Another reason that many respondents stayed at the site was the strong solidarity among residents. Social relations with neighbors have been very good for a long time that began when they both occupied the location before the floods and tidal floods that were getting worse and worse.

Table 1. Conditions of respondents' education and employment levels

Education and employment level	Genuk District	Semarang Utara District
	Amount (percentage)	
Education:		
a. Below SMA	14 (56 %)	17 (56 %)
b. SMA	9 (36 %)	12 (40 %)
c. Bachelor (S1)	2 (8 %)	1 (3 %)
Work:		
a. Merchant	10 (40 %)	11 (36 %)
b. Worker	2 (8 %)	5 (16 %)
c. Fishermen	-	4 (13 %)
d. Officer	1 (4 %)	2 (6 %)
e. Does not work	12 (48 %)	6 (20 %)

Source: primary data analysis

Table 2. Respondents' living conditions in flood and tidal flood prone environments

District area	Permanent buildings		Non-permanent buildings
	Elevated	Not yet elevated	
Genuk	21	6	1
Semarang Utara	20	9	-

Source: primary data analysis

Table 3. Why respondents stay on site

District area	Reasons for staying on site		Desire to move location
	Family/hereditary	Economy/employment	
Genuk	18 (94 %)	1 (5 %)	11 (36 %)
Semarang Utara	13 (46 %)	15 (53 %)	12 (40 %)

Source: primary data analysis

Some respondents both living in Genuk 36% and North Semarang 40% chose the desire to move to another location. This will be done if there is a cost to move, namely buying land and building a house in a new place. When asked what are their expectations with the environmental situation that complicates their lives? They hope that someday the government can overcome the problem of floods and tidal floods so that one day they will be free from floods and tidal disasters.
According to the results of research conducted by Sarbidi (2002) that in coastal areas, tidal flooding causes the floor of the house / building to be elevated at least 10-50 cm every 5 years. When the life of the building reaches more than 15 years, the walls become short. Poor people usually stay with the existing conditions or dismantle the roof and connect the columns and walls of the house up, while the people who can afford it, usually have their houses completely overhauled and build new houses. Meanwhile, according to Suhaeni (2002), several losses due to tidal floods, including residents have to incur additional costs to raise the floor every 2-3 years, then incur additional costs to connect the walls and roof of the house every 10-15 years. This condition is still ongoing today.
Yunanto &; Mayangsari (2017) calculated the population affected by floods and tidal floods in Semarang City as many as 395,877 people with recommendations for these residents to be relocated to a safer place from the risk of flooding and tidal flooding by making flats. Making flats is a cheap solution with the least level of land needs. The distance of the flats to the original work location is the main consideration of choice for residents affected by floods and tidal floods. Research by Erlani & Nugrahandika (2019) shows that in the mitigation stage community activities, namely the elevation of house buildings and road elevation, while the activities of the Semarang City Government include the construction of dikes, making parapets (water barrier walls), making pump houses and retention ponds, cleaning drainage channels.

CONCLUSION

The physical adaptation of the community in facing the situation of living in areas prone to floods and tidal disasters is to maintain buildings through land backfill and building elevation.
The psycho-social response of the community in facing the situation of living in areas prone to floods and tidal disasters is to choose to stay in their respective residences considering that they have lived for a long time because they were born and raised in that location and work location not far from where they live. Flood and tidal problems are considered normal and solidarity between individuals has been well established.

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