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Urbanization and Climate Resilience: How is Vulnerability and Poverty in Makassar

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Abstract: *This article examines how the processes of urbanization and climate resilience are related to vulnerability and poverty. This article aims to determine the correlation between climate resilience, vulnerability, and poverty. From a methodological point of view, this is qualitative research using the collection of documents, such as the Regional Action Plan for Climate Change Adaptation-Disaster Risk Reduction (RAD API-PRB) and documents from government websites. The findings of this study illustrate that urbanization followed by development impacts land-use change. Land degradation due to urbanization and climate change will have direct human impacts due to extreme events and increased vulnerability, with significant environmental, economic, and social consequences for communities, particularly the poorest communities, who are most vulnerable. We suggest developing ways to reduce vulnerability through strategic management planning to reduce exposure to stress, sensitivity, and adaptive capacity.*

Keywords*: Urbanization; Climate Resilience; Vulnerability; Poverty*

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Introduction

Most of the world's population growth is occurring in urban areas in low- and middle-income countries, which is likely to continue (Satterthwaite, 2009). The urban population has experienced a substantial increase in the last 30 years, and the global percentage is projected to exceed 65% of the total population by 2050 (Argüeso et al., 2014). Urban growth factors or urbanization also contribute to increasing urban vulnerabilities, such as increasing pressure on groups exposed to higher vulnerabilities, such as the poor, women, children, the elderly, and people with disabilities, to adapt to climate change (Rusnaedy et al., 2021; Malik et al., 2021).

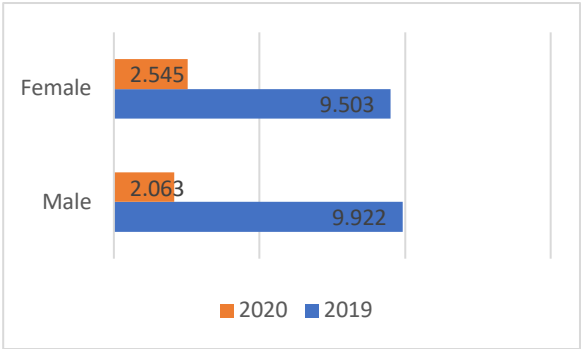
Urbanization always increases the risk of disasters due to increased vulnerability due to increased population, the concentration of wealth, and infrastructure in smaller areas (Ishigaki et al., 2013). Urbanization encourages land use and changes in a microclimate, resulting in changes in hydrology and hydroclimatology in the short or long term, resulting in natural disasters (Weng, 2009).

Urban population growth is increasingly drawing the scientific community's attention to urban climate and the effects of urbanization at different scales (Chen et al., 2021; Zango et al., 2021). Scientists agree that rapid urbanization and climate change increase the vulnerability of poor urban communities to natural hazards, which weakens urban resilience (Williams et al., 2019; Zhao et al., 2016; Zhou et al., 2019), especially in developing countries that feel the impact and vulnerability of climate change with all its consequences (Bazilian et al., 2011; Biagini & Miller, 2013).

Developing countries are more interested in designing ways to mitigate and adapt to climate change, as they are most vulnerable to its adverse effects (e.g., large parts of Africa, Asia, and Latin America are generally within the range of 0.5°C to 1.0°C over the past 30 years). Thus, developing countries need full access to information on all aspects of climate change, including the contribution of countries and regions to the growth of greenhouse gas emissions, regional climate change, and the projected impact of climate change on ecosystems, the economy, technology, and capital (Ravindranath & Sathaye, 2002; Thornton & Gerber, 2010).

Makassar, one of the big cities in Indonesia, is a coastal area that feels the big impact of climate change (Soentoro, 2017; Rusnaedy et al., 2021). Makassar, the largest city in eastern Indonesia, is a location for commercial and economic activities that encourage the movement of socio-economic functions. This illustrates that the urbanization process is a process driven by economic change and human resources, natural resources, and technology and has economic, social, and physical impacts as well as problems faced in urban development policies (Fitrianti et al., 2021; Surya, 2016).

Graph 1.
Urbanization in Makassar



Source: Department of Population and Civil Registration, 2021

Slum areas that are concentrated in the coastal area of Makassar are synonymous with poverty, violence, crime, endemics, and disasters due to climate change, such as tidal flooding, storm surges, and sea-level rise (Losada et al., 2019; Toimil et al., 2020). Climate change does not only impact the environment; economic activity and job losses are also direct or indirect results of climate change.

Resilience has been applied to the urbanization process, where urban areas are framed as complex social-ecological systems (Heynen, 2014; Simon, 2007). As a metropolitan city, Makassar is increasingly dependent on complex infrastructure, energy, food, water, transportation, communication, and accompanying socio-cultural systems that are vulnerable to climate change, especially the poor as the community most affected (Friend & Moench, 2013).

The problem of climate change in the city of Makassar that can be observed is an increase in temperature of around 0.3 °C per decade over the last 30 years, such as the average temperature in Indonesia. Flooding due to urban drainage systems not being able to accommodate sufficient amounts of water and air pollution produced by vehicles, factories, etc. can increase your risk of developing respiratory problems and other illnesses. A crucial issue is public awareness of the dangers of climate change. The impact of people's lifestyles, such as littering and using public transportation massively, will only be felt after some time, so it does not create awareness that what they are doing will threaten their lives in the following years.

Another issue that is still less debated is the tendency to ignore the 'negative' side of resilience. Resilience is still too often presented as a normative goal to be addressed and ignores the welfare aspect. In their research, Béné et al. (2014) show that, for individuals or communities, resilience is not always positively correlated with well-being. Some households may have succeeded in strengthening their resilience, but only to the detriment of their well-being or self-esteem.

Method

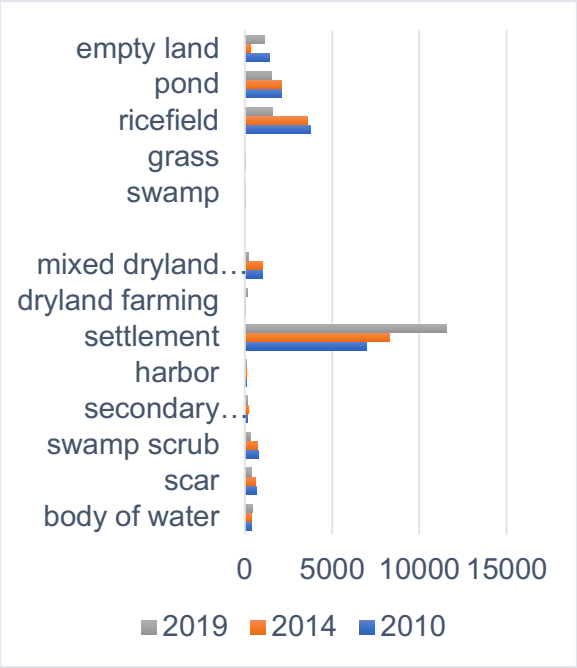
This research uses a qualitative approach with data collection techniques from the Makassar Climate Change Adaptation-Reduction Regional Action Plan (RAD API-PRB) in 2020 and documents from government websites: Regional Planning and Development Agency, Population and Family Planning Agency, and Department of Population and Family Planning. Social, Environmental Service, Health Office and Education Office. These data were compiled to look at trends in urbanization and climate resilience linked to poverty and vulnerability. Urbanization data is associated with land degradation and conversion to see climate resilience, which impacts vulnerability and poverty in Makassar City.

Result and Discussion

Area Vulnerabilities

Based on the land use map of the Ministry of Environment and Forestry, in Makassar City, there are 13 types of land use, namely secondary mangrove forest, shrubs, swamp thickets, ports, settlements, dryland agriculture, mixed dryland agriculture, swamp, grass, rice fields, ponds, vacant land, and bodies of water.

Graph 2.
Land use in Makassar 2020



Source: (RAD Makassar, 2020)

The vulnerability level of the village is determined using SIDIK (Vulnerability Index Data Information System), which is the result of calculations from vulnerability indicators, namely indicators of exposure, sensitivity, and adaptive capacity of the village. Exposure is a description of an object such as land area, number of people, or activities in a system that may be exposed to environmental disturbances such as climate-related disasters such as floods and droughts. Meanwhile, the sensitivity level represents the internal condition that shows the degree of vulnerability to disturbances caused by disasters. Exposure and sensitivity data are represented by exposure and sensitivity indicators.

Therefore, exposure and sensitivity indicators can determine the affected sectors. Adaptive capacity represents the ability of an urban village to adapt to or deal with climate change. Adaptation is a long-term adjustment to a hazardous event, such as a disaster. Indicators of adaptive ability represent adaptive ability data. Therefore, indicators of adaptive ability can be used to determine the factors of adaptive ability. The first output from the calculation of the Vulnerability Index Data Information System is the exposure-sensitivity index value and the adaptive ability index, which are then used to determine the level of vulnerability of an area.

Based on the availability of data and its suitability to represent the level of exposure of an area to the adverse impacts of climate change, including climate diversity and extreme climates, the indicators of exposure, sensitivity, and adaptive capacity of the villages, consisting of 17 indicators, can be analyzed. The number of exposure and sensitivity indicators includes nine, while the number of adaptive capacity indicators includes eight.

Table 1.
Village Vulnerability Level

Adaptive Capacity Indicators	Exposure and Sensitivity Indicators
Educational facilities	Rice field area
Health facilities	Agricultural land area
Tourism	Settlements directly adjacent to the sea
Number of markets	Residential land area
Financial institutions	Population density
Activities to protect the environment	Pre-prosperous family

Non-governmental organizations	Fuel sources
Facilities for garbage disposal	Facilities for garbage disposal Slums

Source: (RAD Makassar, 2020)

The high level of village vulnerability is caused by high exposure and sensitivity to disturbances and disasters in the village. However, it is not accompanied by the village's ability to deal with its impacts. One of the efforts that can be made to reduce the level of vulnerability is the preparation of adaptation actions. Adaptation actions can be integrated with development programs and activities. Adaptation actions that have been successfully implemented can be seen from their impact on development aspects.

The village's exposure, sensitivity, and adaptive capacity were analyzed using the indicators described above. The value of each IKS and IKA indicator is in the range of 0 to 1. Then, the indicator values are grouped into five classes indicating levels, namely, 0-0.2, which indicates a very low value; 0.2–0.4 means low; 0.4–0.6 means moderate; 0.6–0.8 means high; and 0.8–1.0 means very high. This is stated in the Makassar City Regional Action Plan, 2020 (see table 2).

The tables and figures presented in the article should include a caption with a title placed above the table and below the image in the center of the page, as shown below:

1. Level of Exposure and Sensitivity of Makassar City, The number of indicators of the level of exposure and sensitivity in Makassar City is nine. Nine indicators of exposure and sensitivity are included in the six affected sectors, namely agriculture and forestry, building, spatial planning, finance, energy, and waste. The building aspect dominates the exposure and sensitivity indicators. This means that these aspects will greatly influence exposure and sensitivity in Makassar City. Indicators included in the agricultural and forestry sectors are the area of paddy fields and the area of non-paddy agricultural land (dry land). The indicator of rice field area and non-rice field agricultural land area is calculated by the proportion of each land use to the total village area. Settlements, namely 41%, dominate land use in Makassar. In comparison, rice fields and agricultural areas (dry land) are only 15% and 8%, and the remaining non-agricultural land and settlements are 36%. This means that the green area in Makassar City is quite low, and the possibility of Large areas do not have sufficient water catchment areas. Lack of water catchment areas can increase the chance of flooding. Population density is an indicator of sensitivity exposure in Makassar City, which is included in the spatial planning sector. The government can use this indicator to prepare a Regional Spatial Plan (RTRW); a better RTRW is expected to reduce exposure and village sensitivity to climate change risks. Based on the financially impacted sector, the indicator represents the indicator of poor families. Heads of underprivileged families are the household heads who cannot fulfill their main needs, such as clothing, food, housing, and access to health facilities (BKKBN 2011). In addition,

the indicators of slum settlements are also closely related to the level of poverty and the community's quality of life, especially in the aspect of housing. People who live in slums have poor environmental sanitation, and most of the building construction is unfit for habitation. Communities with high levels of poverty will be more easily exposed and sensitive to the impacts of climate change risks. Therefore, development efforts by improving the community's quality of life are expected to reduce the level of poverty and the level of exposure and sensitivity in the community.

2. Adaptive Capability Level Eight indicators of adaptive capacity are included in the adaptive capacity factors: tourism, education, health, socio-economics, government governance, infrastructure, and environment. Indicators that are included in the education aspect are indicators of educational facilities. The education facilities indicator describes the number of educational facilities such as elementary schools, junior high schools, high/vocational high schools, and universities in a village. The health aspect is represented by indicators of educational facilities that provide information on the number of health facilities, such as the number of health centers and hospitals in a village. The socio-economic aspect is represented by the number of markets and financial institutions. Indicators of environmental protection activities represent aspects of government governance.
3. Village Vulnerability Levels of village vulnerability in Makassar City are in the very low, quite low, medium, quite high, high, and very high classes. The majority of villages in Makassar City are at a fairly high level of vulnerability. A total of 53 villages, or 35% of the total villages in Makassar City, have a fairly high level of vulnerability. Four villages are at a very high level of vulnerability. The display of the spatial distribution of the vulnerability level of villages in Makassar City was obtained using the Vulnerability Index Data Information System (SIDIK).

Table 2. Village Vulnerability Levels

Vulnerability Category	Number of Villages	Percentage
Very low	32	21
Low	0	0
Pretty low	1	1
Currently	34	22
Moderate enough	53	35
Tall	29	19
Very high	4	3

Source: (RAD Makassar, 2020)

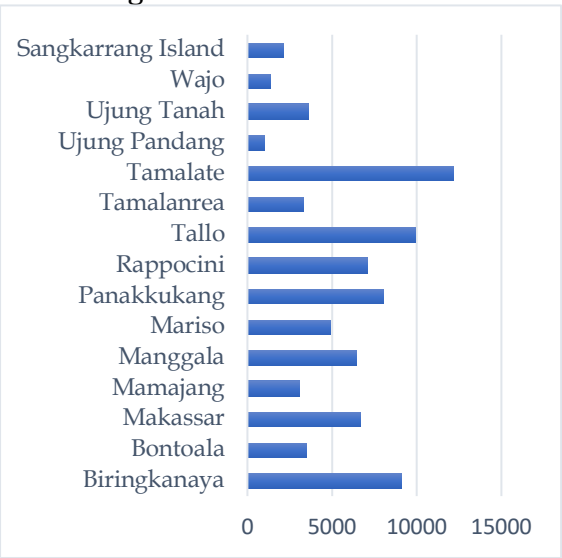
Analysis of the village vulnerability level matrix resulted in the conditions of the village's Adaptive Ability Index (IKA) and Exposure & Sensitivity Index (IKS), grouped based on the level of vulnerability. Then, the IKA and IKS values

at a certain level of vulnerability are compared with the average of all indicator values in Makassar City. The majority of villages in Makassar City have a fairly high level of vulnerability. It can also be seen from the spider-graph pattern that the average Makassar City indicator is almost similar to the IKA and IKS values in the fairly high vulnerability category. Suppose the IKA value in this category is quite high compared to the IKA value in the very low category. In that case, villages with a very low level of vulnerability have a much higher adaptive capacity. Then, villages with a high level of vulnerability have very low values for indicators of adaptive capacity. This can indicate that the level of adaptive capacity plays a very important role in determining the level of vulnerability of a village. Therefore, the government needs to make development efforts to improve the adaptive capacity of the people in Makassar City, who face threats related to climate change.

Separating Poverty and Vulnerability

Graph 3.

Integrated Social Welfare Data



Source: social services, 2020

Several studies, for example (Armitage et al., 2012; Coulthard, 2012; Davidson, 2010), highlight the potential trade-off between resilience and well-being. In short, a person can be very poor and unhealthy but very tough. Wood makes this point in his analysis of the strategies adopted by the poorest and poorest when he says that a deliberate strategy of selecting levels of poverty reduction as a social condition for securing sustainable livelihoods, even though low rates [are also included]...acceptance of ambition cut off from self-improvement and advancement to secure basic well-being' (Béné et al., 2014; Wood, 2003).

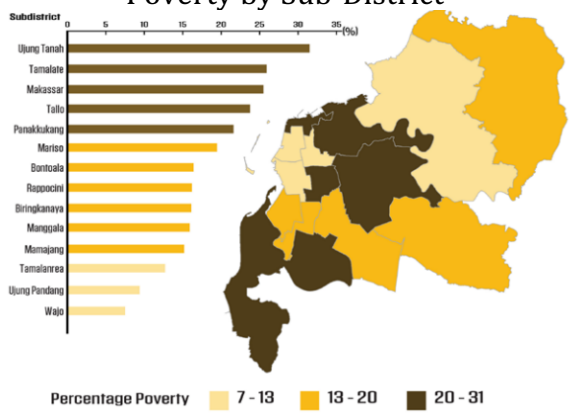
The concept of resilience that is simplistic and does not reflect social and political issues will inevitably experience substantial difficulties (Cannon & Müller-Mahn, 2010; Davidson, 2010; Duit & Galaz, 2008), and other concepts such as vulnerability, which have a stronger 'social/actor' focus, are far superior to resilience in terms of emphasizing issues around social justice or the distribution of power. By reframing climate change or disaster issues into a resilience framework, there is, therefore, a risk of 'retreating' to technical and apolitical interpretations, with the risk that the social and transformative justice dimensions of these interventions are ignored or forgotten.

Poverty in the Framework of Development and Climate Resilience

In some areas, poverty reaches up to 31% of the population; the area varies, but poor communities are common in urban centers and along the coast. The city's continuous development allows the economy to continue to grow, increasing industrial and commercial activities. For settlements and coastal communities scattered across islands, fishing is their

main economic activity. Some of them go to the sea to look for sea cucumbers that benefit from the Hong Kong and Singapore markets, where these cucumbers are used for cosmetics and special medicines. However, for more than 3,000 fishermen who come from Makassar, fishing is becoming a livelihood that is becoming increasingly difficult due to declining supplies and having to sail farther from the coast to get fish. There seem to be many workers from coastal communities looking for work in the urban sector (UNDP et al., 2013).

Figure 1.
Poverty by Sub-District



Source: (UNDP et al., 2013)

Apart from being identical to slums, the coastal area of Makassar City is also the most affected by climate change. Most coastal communities fishermen hope that their catch can meet their daily needs. However, the shift in development from the center to the coast is increasing. The Makassar City Government and South Sulawesi Province are planning the reclamation of 3,133.29 hectares in the Makassar City RTRW 2015–2034, which is strengthened in the South Sulawesi Province Zoning Plan for Coastal Areas and Small Islands (RZWP3K) document for 2019–2039.

The allocation of coastal areas for reclamation threatens the existence of this ecosystem. In comparison, the function of the mangrove ecosystem as a feeding and nursery ground accounts for 75% of coastal fisheries commodities. Not to mention its physical ability to guard against intrusion and abrasion. Makassar City's mangroves are shrinking from year to year due to the pressure on coastal space use. Makassar City Maritime Affairs and Fisheries Service data in the 2016 Mangrove Data Accuracy Report shows that the mangrove area has drastically shrunk in the last fifteen years. Depreciation reached 76%, covering an area of 411.7 hectares in 2001 and decreasing to 100.07 hectares in 2016.

The shrinking of mangrove forests, apart from the primary value of mangroves as coastal protection, habitat for fish and wildlife, sediment and pollution filtration, and carbon sequestration (Ellison, 2015; Van Lavieren et al., 2012), will have an impact on sea-level rise and tidal flooding. Urbanization is followed by a shift in development from urban centers to coastal areas that contribute to climate change and disasters (Ellison, 2015). The degradation and loss of these coastal buffer systems due to climate change will have direct human impacts that deprive them of the coastal protection afforded during extreme events and increase their vulnerability, with significant environmental, economic, and social consequences for the urban coastal poor.

Makassar Government Strategy

Angelia (2019) calculated the vulnerability class for 25 sub-districts in the coastal area of Makassar.

Table 3. Makassar Coastal Area Vulnerability Class Level

No	Village	Vulnerability Indicator		
		Adaptive Capacities	**Potential Impact (sensitivity & exposure)**	**Level**
1	Untia	Low	Low	Low
2	Bira	Low	Low	Low
3	Parangloe	Low	Medium	High
4	Tallo	Medium	Low	Low
5	Buloa	Medium	Medium	Medium
6	Kaluku Bodoa	Medium	Medium	Medium
7	Cambayya	Medium	Medium	Medium
8	Gusung	Medium	Medium	Medium
9	Totaka	Low	Medium	High
10	Tamalabba	Low	Medium	High
11	Ujung Tanah	Low	High	High
12	Mampu	Low	High	High
13	Butung	Low	High	High
14	Melayu Baru	High	High	High
15	Ende	Medium	High	High
16	Pattunuan	Medium	High	High
17	Bulo Gading	Low	High	High
18	Maloku	Low	High	High
19	Losari	Low	High	High
20	Panambungan	Medium	High	High
21	Mattoangin	Medium	High	High
22	Bontorannu	Medium	Medium	Medium
23	Maccini Sombala	Low	High	High
24	Tanjung Merdeka	Low	High	High
25	Barombong	Low	Low	Low

Source: (Khairunnis, 2019)

Based on the results of a literature and theory study on adaptation strategies to the impacts of climate change, the adaptation strategies that can be implemented in the Makassar City Coastal Area are protective and accommodative strategies. The accommodative strategy is carried out in villages that have low and medium vulnerability impacts, which include preventive measures, adaptation measures in the form of mangrove and coastal forest restoration, maintenance of settlement infrastructure, maintenance of rivers as runoff areas, maintenance of natural coastlines, and development regulations for coastal protection. Whereas the protective strategy is carried out in sub-districts with a high vulnerability impact, which is an action to increase resilience, adaptation measures are in the form of building buildings in the form of protective walls along the coast, for example, the construction of sea walls, revetments, and bulkheads. In addition, it is necessary to develop ways to reduce vulnerability through strategic management planning to reduce exposure to stress, sensitivity, and adaptive capacity.

Conclusion

The urban growth rate is inherently positive, with an unstoppable increase in urbanization and its complex consequences. Land degradation due to urbanization and climate change will have

direct human impacts due to extreme events and increased vulnerability, with significant environmental, economic, and social consequences for communities, particularly the poorest communities, who are most vulnerable. Makassar City shows itself as an area vulnerable to climate change that has not been able to adapt well. This vulnerability is inherent in the number of poor people as a direct and indirect result of climate change. Coastal areas are the most vulnerable to the impact of urbanization and climate change. Urban development that shifts from the center to the coast degrades mangrove areas. Not only does it eliminate fish habitat as a source of life for fishermen, but it also impacts the lack of sediment filtration, pollution, and carbon sequestration, which sooner or later will result in climate disasters such as sea-level rise and tidal flooding. Therefore, we suggest developing ways to reduce vulnerability through strategic management planning to reduce exposure to stress, sensitivity, and adaptive capacity.

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