



Integration of Disaster Management Strategies with Planning and Creating Green Open Spaces in Probolinggo City

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Abstract

Planning and creating public open spaces has been influenced by the current focus on building sustainable cities that support its three pillars—economic, social, and environmental. However, the negative effects of expanding urbanization and the consequences of climate change have increased the possibility of disaster in cities and increased pressure on the path toward sustainable development. Public open spaces are often used as a strategy to enhance cities' sustainability while using it as a mode to improve the quality of life, aesthetic beauty, environmental health, economic growth and to increase the walkability, live ability and vitality of cities. In order to mitigate the effects of disasters, it is also important to pay attention to how public green open space is managed in terms of governance, finances, rules, oversight, and human resources. Socialization of this activity is necessary so that the general public is aware of the purposes and advantages of having public green open space. In addition to serving as an environmental buffer, Probolinggo City's public green open space has the potential to be developed as a disaster mitigation model using a sustainable development approach, bringing benefits for the environment, education, infrastructure, economy, and socio-cultural aspects in line with the SDGs.

Keywords: *Green Open Space; Sustainable Cities; Sustainable Development Goals*

1. Introduction

The contemporary emphasis on constructing sustainable cities that support its three pillars is a economic, social, and environmental has dominated planning and designing public open spaces. The adverse effects of growing urbanization and the impact of climate change, however, have raised the

likelihood of disaster in cities and put more pressure on the course of sustainable development. Therefore, it is crucial to combine measures for sustainable development with improvements to catastrophe resilience. However, there is still little experience in the urban planning context with integrating disaster management tactics with planning and developing public open spaces. In order to plan and build public open spaces in cities, this ongoing research study underlines the necessity of integrating disaster management tactics with sustainable development strategies (Jayakody et al., 2018).

Indonesia is currently experiencing a very significant decline in the quantity and quality of public open space, particularly Green Open Space (RTH). This has led to a deterioration in the urban environment, which has an effect on a number of aspects of urban life, including frequent disasters, increased air pollution, and decreased community productivity due to a lack of space for social interaction. The current development is primarily focused on filling urban spaces with infrastructure and utilities in the form of physical buildings, which is out of balance with the availability of sufficient open spaces, especially green open spaces (Achsani, 2016).

One of the most common calamities in the Probolinggo City Spatial Plan for 2009 to 2018 is floods. Probolinggo City is vulnerable to a number of disasters in addition to flooding, including strong winds, tidal waves that harm inhabitants' ponds and property, the threat of ash and cool lava gushing from Mount Bromo, and fires brought on by the city's dense population of buildings. The depletion of groundwater absorption caused by new dwelling structures has also resulted in numerous regions in the past few years experiencing water shortages during the dry season. Apart from that, the implications of climate change further increase the risk of natural disasters in cities with an increase in weatherrelated disasters (Schipper and Pelling, 2006) and accelerated global sea-level riserelated coastal hazards (Nicholls, 2011). Further, this increase of disaster risks in cities mounts more pressure on the path to sustainable cities. Therefore, it is inevitably important to incorporate the enhancement of disaster resilience into cities' sustainable development.

The Probolinggo City Government created the RPJMD in 2017 after compiling a Disaster Management Plan (RPB) Document. This document serves as a roadmap for adopting disaster management procedures in Probolinggo City so that it can be done more methodically, in advance, and without overlooking anything crucial. One method of disaster mitigation, particularly in metropolitan places like Probolinggo City, is to create a balance between the areas that are already there, whether they are being used for homes, businesses, offices, rice fields, or green open spaces. The Probolinggo City Regional Regulation No. 11 of 2018 Concerning Disaster Management regulates this type of balance that can prevent environmental harm and calamities.

2. Material and Methods

2.1. Literature Review

Indonesia is a country with a high level of vulnerability to natural disasters. Its location at the confluence of the world's active plates can cause geological disasters. In addition, astronomically, Indonesia is located in the equatorial zone with a tropical climate with a risk of hydrometeorological disasters. This is an indication that in regional development plans, the government should not only be based on development needs, but also need to consider aspects of disaster hazards that can hinder sustainable development in this country (Taslim et al., 2017).

One of the development concepts that is currently a role model in various countries is sustainable development. The Government of Indonesia has outlined this sustainable development effort in Presidential Regulation Number 59 of 2017 concerning the Implementation of Achieving the Sustainable

Development Goals. The Sustainable Development Goals, hereinafter abbreviated as TPB, are documents that contain global goals and targets from 2016 to 2030 (Perpres No. 59, 2017). The TPB has been compiled and synergized with the Nawacita and the National Medium Term Development Plan (RPJMN) 2015 - 2019.

There is growing pressure for urban planning to play a bigger role in managing water resources as urban development's impact on the hydrological functions of water is becoming more widely recognized. Planning for green open areas in particular can be crucial because they support vital ecosystem functions, such as those that help with flood control (Schuch et al., 2017). Having access to public open spaces is essential for city living. Aesthetic, social, political, and economic requirements are all met by these locations. The size and scope of public open spaces offered in a city often influence the level of development of a nation. Urban public open spaces serve a variety of purposes, such as recreation, offering services that draw and keep people in jobs, a lively culture, and talented people, and preserving a city's unique appearance, history, and beauty (Makworo & Mireri, 2011).

Efforts to develop open space are inseparable from the Regulation of the Minister of Public Works No. 05/PRT/M/2008 concerning Guidelines for Provision and Utilization of Green Open Space in Urban Areas, which is a derivative regulation of Law No. 26 of 2007 concerning Spatial Planning. The Minister of Public Works' Regulation requires the establishment of up to 30% green open space, which is accomplished gradually. The provision of green open space is based on three factors, including size, population, and the necessity for certain functions, according to the attachment to the Regulation of the Minister of Public Works published in 2008. The creation of green open space aims to assure the availability of spaces for biodiversity development, natural resource development, disaster mitigation/evacuation, and conserved areas for hydrological sustainability. Cities are intricate social-ecological landscape systems that are confronted with many difficulties, such as climate change, aging populations, the loss of natural resources, and intensive urbanization (Burkhard et al. 2010; McPhearson et al. 2014; Pickett et al. 2001). Particularly requiring a lot of resources, the construction industry puts a lot of strain on metropolitan environments. However, as urbanization continues to grow, it endangers human welfare, environmental services, and biodiversity in urban settings (Haase et al. 2014). Because of this, the current trend in urban landscape planning emphasizes the crucial role that green open spaces play in creating resilient urban landscapes and enhancing the wellbeing of urban society.

Public open spaces can be built with the economic benefits for communities and residents in mind in addition to the immediate benefits. Promoting aesthetic, historical, and recreational aspects, for instance, through the city's public open spaces benefits the tourism sector, which increases job possibilities and revenue for the municipality. Additionally, recreational and natural features raise home values and consequently tax income (Chiesura, 2004). This is supported by Tajima's (2003) claim that parks and other open areas increase a property's worth or sales price. Similar to how private open space can aid in the overall development of a region and its urban fabric. First, it affects investments in improving the quality of public open space, which makes people more drawn to these recreational amenities and high-quality public locations (Wu and Plantinga, 2003). Second, inhabitants like to live close to public open spaces and have access to them. In conclusion, the literature review above identifies four key topics on which planners and designers tend to concentrate when creating public open spaces. These include the city's liveability, sociocultural advantages, environmental advantages, and economic advantages. As a result, it should be mentioned that public open spaces support sustainable cities on the social, economic, and environmental fronts.

In accordance with Regulation of the Minister of Public Works Number 5 of 2008 concerning Guidelines for the Provision and Utilization of Green Open Spaces in Urban Areas, a Green Open Space (RTH) is a lengthy, open space where either naturally growing or artificially grown plants can be found.

In the meantime, a green open space is a portion of an open space that is covered in plants, herbs, and flora in order to benefit from the security, comfort, welfare, and beauty of an area. Green and non-green open spaces are the two types of public open spaces that are typically found in urban areas. Urban Green Open Space (RTH) is a term used to describe a portion of an urban area's open spaces that are planted with flowers, gardens, and other flora to support ecological, sociocultural, and architectural advantages that may bring about economic advantages (welfare) for the neighborhood. Blue open space, such as the surface of rivers, lakes, or locations designated as retention ponds, is another type of non-green open space (Dwiyanto, 2009).

A general planning document for the Regional Apparatus Work Unit (SKPD) for a period of 5 (five) years, the Strategic Plan of the Probolinggo City Environment Service for 2020-2024 is indicative and guided by the Regional Medium-Term Development Plan (RPJMD), as required by Government Regulation Number 8 of 2008 concerning Stages, Procedures for Preparation, Control, and Evaluation of the Implementation of Regional Development Plans. In order to ensure connections and consistency between planning, budgeting, implementation, control, and evaluation, the government enacted Law No. 25 of 2004 concerning the National Development Planning System, which mandates that Regional Development Planning is an integral part of the national development planning system. The Mayor of Probolinggo's vision, Building Together with the People for a Better, Just, Prosperous, Transparent and Sustainable Probolinggo City, as well as the third mission of realizing infrastructure and environmental development sustainable living, are both supported by the integration of the Environmental Agency's Strategic Plan with the Probolinggo City Medium-Term Development Plan (RPJMD).

An endeavor to organize green open spaces in the city to lessen the danger of occurrences or events that threaten and disturb people's lives and livelihoods is known as disaster mitigation via the management of Green Open Space (RTH). Physical advancement, increased awareness, and capacity building can all be used to mitigate the effects of disasters. Disasters are situations that pose a threat to, interrupt daily life, and may inflict deaths, property losses, environmental harm, and psychological effects due to both natural and human sources (HSEM, 2009 and TDMRC, 2010). By taking into account the evacuation routes and tsunami catastrophe zones that were developed by the Bali government in 2010, the green open space model for disaster mitigation can be used.

Application of macro and micro provincial space based on population, population density, and city spatial planning in the Sanur area. According to Rashifah (2019), the model is used with the function of the green open space as a discovery space identified to facilitate the process or travel alone and there can be casualties when an earthquake occurs. The model is applied with the division of the green open space as a zone in Sanur based on the social and geographical conditions currently in place, as well as several considerations like the division according to clusters in natural disaster mitigation procedures. An effort is being made to increase the role as a provider of environmental services, so one of the concepts is through the development of integrated green open space, also known as green infrastructure. The purpose of the existence of Public Green Open Space (RTH) and the relevance of disaster mitigation at this time is to increase those roles (IH). The development of green open space as an IH should, in accordance with Sinatra et al., (2022), be focused on improving urban aesthetics, health and welfare, integration and connectivity, disaster mitigation, and climate change adaptation.

2.2. Research Location

In the province of East Java's Probolinggo City, this study was carried out. The choice of the research site was planned, taking into account that this region has excellent potential for the agricultural sector, both in terms of usage and for development, so that it contributes significantly to future regional economic growth. This study was carried out in Probolinggo, with a particular emphasis on the region

used for grape production. Because it is a development region for grape production, this place was picked. There are also quite a few farmers in the area that own and operate farms. Additionally, the location was picked for its accessibility to the area. The study was carried out between January and November of 2022. Geographically, the research location in Probolinggo City can be seen in the following figure 1.

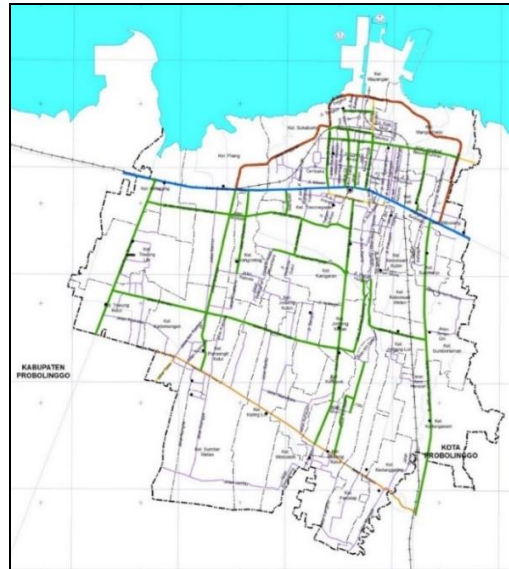


Figure 1. Map of Research Locations

2.3. Method and Data Analysis

This study uses a qualitative research approach where qualitative research as a scientific method is often used and carried out by a group of researchers in the social sciences, including environmental sciences. This research was conducted in Probolinggo City, East Java Province. The major data required for this study is data on the factors that enable the administration of Public Green Open Spaces (RTH) as a model for disaster mitigation in Probolinggo City. This data was gathered in the field using direct survey methods and interviews. Data on governance, finances, rules, and human resources in various sub-district locations were gathered using the survey approach. The determination of the research location was carried out intentionally, with the following reasons and considerations:

- 1) Public Green Open Space (RTH) in the city of Probolinggo is a priority program of the Probolinggo City Government in order to follow up the explanation of article 29 paragraph 1 of the Law of the Republic of Indonesia number 26 of 2007 concerning Spatial Planning that Public Green Open Space is a green open space owned and managed by the local government of the city which is used for the benefit of the general public;
- 2) The integration of the Environmental Agency's RENSTRA with the Probolinggo City Medium-Term Development Plan (RPJMD) in line with the Probolinggo Mayor's vision of building together with the people for a better, just, prosperous, transparent and sustainable Probolinggo City, as well as the third mission of realizing infrastructure development and a sustainable environment through improving the management of green open spaces in order to improve the quality of the urban environment through the preservation, prevention and control of environmental damage.

First, informants served as the study's data sources. The informant's position provided an answer to the researcher's questions. Second, documents, often known as archives, might take the form of formal records or written content. Data from interviews with informants who frequent the public green open

space, the neighborhood, local leaders, stakeholders, and managers of the public green open space were used in this study. operational monitoring of the creation of public green spaces and recording of those activities. The method used in collecting information and data used in this research is Participatory Rapid Appraisal (PRA).

3. Results and Discussion

Disaster Mitigation with a Sustainable Development Approach in Public Green Open Space (RTH) in Probolinggo City. In relation to the disaster mitigation model with a sustainable development approach in the Public Green Open Space (RTH) in the City of Probolinggo, efforts to improve the quality and innovation of the public green open space management model as a sustainable development plan for disaster mitigation as well as resource potential development related to SDG's, Public Green Open Space Managers are required to seeks to improve the welfare of society, social dynamics and maintain ecological harmony.

- a) Public Green Open Space (RTH) data as disaster mitigation. The green function in public green open space as the 'lungs of the city', is actually only one aspect of the ongoing recycling function, between carbon dioxide (CO₂) and oxygen (O₂) gases, the result of photosynthesis, especially in leaves. This green system is like the function of air ventilation in a house. Moreover, there are many functions of TWSL, including aesthetic functions that are useful as a source of active and passive public recreation, which are manifested in the green corridor system as a land spatial control tool in an urban park system. Apart from being about how to deal with the impacts of global warming and cities and protecting natural resources, public green open space also functions as a source of water reservoirs and a regulator of the hot and humid tropical climate (shade). The realization of public green open space (RTH) management policies and models as disaster mitigation related to the SDG's goals as the goals of the 1st Sustainable Development Goals (SDG's) on alleviating all forms of poverty and the 13th Sustainable Development Goals (SDG's) on how to deal with the impacts of warming global.
- b) Data on Public Green Open Space (RTH) as a means of tourism, ecological and socio-economic. The policy and model of the Management of Public Green Open Space (RTH) as a tourism, ecological and socio-economic means is related to the 11th SDG's goal of inclusive, safe, resilient, and sustainable cities and human settlements. And the 15th Sustainable Development Goals (SDG's) concerning the protection of natural resources and wildlife (land ecosystems).

Management of Public Green Open Space (RTH) for disaster mitigation in Probolinggo City. Management of Public Green Open Space (RTH) for disaster mitigation as an effort to anticipate, adapt, protect, and minimize regional threats, as well as have the capacity to absorb information. The resilience of the community independently in disaster management is the first in every disaster management effort through Provision of Public Green Open Space (RTH) for disaster mitigation and Provision of supporting facilities and infrastructure for disaster mitigation in Public Green Open Space (RTH). The existence of the Probolinggo City Regional Disaster Management Agency (BPBD) for disaster mitigation. Disaster management places green open space (RTH) as the backbone of disaster alert city development. Disaster-prone points (floods, fires, earthquakes) are used as starting points for assessment and city planning for disaster alerts. According to the Probolinggo City BPBD (2021), Building public awareness, especially in disaster-prone locations, to voluntarily switch to urban and livable flats will provide evacuation routes. Others, disaster evacuation rooms, water catchment areas, efficient transportation costs, saving the burden of collective living costs using electricity and clean water, hygienic sanitation, environmental hygiene, waste management, forming a culture of healthy behavior, and responding to disasters. In the Probolinggo City Regional Regulation Number 1 of 2020 concerning the Probolinggo City's Regional Spatial Plan (RTRW) for 2020-2040, it has been determined that in Probolinggo City there are several disaster-prone

areas such as floods, strong winds, tidal waves that damage residents' land and ponds, the threat of ash and cold lava flooding of Mount Bromo, as well as fires caused by the high density of buildings.

Potential Management of Public Green Open Space (RTH) for disaster mitigation in Probolinggo City. Regarding the potential of Public Green Open Space Management (RTH) for efforts to reduce the threat of disaster areas in Probolinggo City, there are opinions from several respondents from this study. Currently, green open space in Probolinggo City can function as a means of disaster mitigation and what needs to be considered is the mapping of public green open space in accordance with disaster-prone potential so that it is in accordance with the planning and utilization of the green open space. Public Green Open Space (RTH) can be used as a means of disaster mitigation and there is a need for mapping, Public Green Open Space (RTH) in accordance with the potential of disaster-prone areas in Probolinggo City, and Public Green Open Space (RTH) as a means to minimize threats the disaster area must be compatible with the vegetation in the Public Green Open Space (RTH). Disaster mitigation is different from preparedness, mitigation is more directed at efforts to prevent or anticipate disasters. The function of the Public Green Open Space (RTH) is an effort to anticipate the impact of the "greenhouse" or agro climate.

One of the efforts to prevent or anticipate the impact of global warming is to maximize the existence of public green open space. The management of public green open space needs to be monitored and evaluated so that we can anticipate disasters. Capacity building for areas threatened by disasters has been carried out by the Environmental Office of the City of Probolinggo by providing public green open space, for this reason it is necessary to support relevant agencies and institutions so that supporting facilities and infrastructure so that the purpose of utilizing public green open space as a means of disaster mitigation can be fulfilled. Disaster mitigation innovation in public green open space can be a strategic step considering the level of disaster vulnerability in Probolinggo City is in a moderate position, this is in accordance with the 2019-2024 Vision and Mission. To be more targeted and sustainable, the management of public green open space must also pay attention to several supporting factors. In order for the management of public green open space to be more targeted and sustainable, a road map must be made relating to:

- a) Technical regulations related to the management of public green open space and disaster mitigation.
- b) Campaign or socialization on the use of public green open space as a means of disaster mitigation.
- c) Fulfillment of disaster infrastructure facilities in public green open space, and
- d) The existence of partnerships with other institutions including CSR.

The existence of public green open space as a means of disaster mitigation must be supported by infrastructure, policies and budgeting. In addition to being supported by infrastructure, policies and budgeting, the public green open space management program as a means of disaster mitigation must be socialized and requires the involvement of other institutions. To minimize the threat of the area, it is necessary to have a mapping of public green open space in accordance with the potential of disaster-prone areas and the suitability of the vegetation in the public green open space. The management of public green open space needs to be monitored and evaluated so that we can anticipate disasters. In addition to being supported by infrastructure, policies and budgeting, the public green open space management program as a means of disaster mitigation must be socialized and requires involvement from other institutions as an effort to increase the capacity of threatened areas to succeed.

The Management of Public Green Open Spaces (RTH) as a Model for Disaster Mitigation in Probolinggo City: The Role of Stakeholders

1. Public open space, lodging, and human resources are provided by the environmental service for disaster mitigation facilities
2. BPBD Probolinggo City, a technical implementer of disasters, offers disaster-related housing and human resources in disaster mitigation activities in Probolinggo City.
3. The Probolinggo City Government Assistant prepares public green open space governance, budgeting, and regulation as catastrophe mitigation.
4. As part of disaster mitigation, DPRD Kota Probolinggo creates the budget and rules for Public Green Open Space.
5. FPRB is a social organization that works to reduce catastrophe risk in Probolinggo City. Its members are volunteers.
6. In order to manage Public Open Space more effectively and efficiently, academics must be involved in the administration of Public Open Space as a disaster mitigation strategy in the City of Probolinggo.
7. Through print and electronic media, journalists help the public learn about the management of Public Green Open Spaces (RTH) as a method of disaster mitigation in the Probolinggo City region.
8. As a method of disaster mitigation in the City of Probolinggo, environmental observers supervise and contribute to the management model of public green open space.
9. As a form of disaster mitigation in the Probolinggo City region, visitors to Public Green Open Space take part in monitoring the administration of the space.
10. As a form of disaster mitigation in the Probolinggo City region, communities near the Public Green Open Space take part in overseeing its administration.

Stakeholders in Probolinggo City wholeheartedly support the management of public green open spaces as a method of disaster mitigation, but governance, budget, rules, and human resources must also be taken into consideration. It is necessary to normalize this activity so that people are aware of the advantages and purposes of having public green areas. The current emphasis on planning and developing public open spaces is mostly dedicated to creating sustainable cities that contribute to all three of the key pillars: social, economic, and environmental, as this study pointed out. Even while improving disaster resilience should be a part of sustainable development, using POS as a technique to do so is not currently taken into account. These public open spaces, however, have a large potential to be exploited for disaster resilience, as a facilitator for emergency evacuation, as an agent of recovery, and as a method to hazard mitigation, according to the review of the literature based on historical disaster events. The question of "How to harness this potential to develop sustainable and disaster resilient cities using public open spaces?" still remains unanswered, despite the fact that public open spaces has a large potential to be exploited for disaster resilience. In order to meet this need, this study is focused on integrating sustainable planning and designing strategies with disaster management strategies. In order to determine the answer, the literature on catastrophe resilience and the literature on urban planning and designing were cross-analyzed. The literature on catastrophe resilience and urban planning was compared, and the results revealed five key planning and designing strategies: 1. mix of diverse POS, 2. adequately plan for daily living, 3. design of open spaces, and 4. maximizing the use of urban space, and 5. designing networks of public open space. Future research with a specific hazard emphasis or with a context-specific focus can also test and assess these literature-based conclusions.

Conclusion

Based on the description of the data above and some emphasis and explanation at several points of the description, it can be drawn that Probolinggo City is a city with a moderate level of vulnerability with a value of 108.30. Tidal waves, building fires, high winds, floods, and cold lava streams from Mount Bromo's eruption are examples of frequent natural disasters. According to their duties and responsibilities, all stakeholders in Probolinggo City completely support the maintenance of public green open space as a

method of disaster mitigation. In order to mitigate the effects of disasters, it is also important to pay attention to how public green open space is managed in terms of governance, finances, rules, oversight, and human resources. Socialization of this activity is necessary so that the general public is aware of the purposes and advantages of having public green open space. In order to plan and design public open spaces in cities, this ongoing research study intends to identify cutting-edge planning and designing approaches that are integrated with disaster management strategies. In order to compare the identified disaster management tactics with sustainable planning and design strategies, this research article analyzes the body of literature already in existence looking at the use of public open spaces in previous disaster occurrences. Finally, the research presents five key methods for incorporating disaster management principles into the development of public open spaces.

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