

DISASTER LITERACY ON GEOTOURISM ROUTES

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Abstract

North Bandung Area, Indonesia, has a high level of geological disaster risk; however, it remains the main destination for tourists to Bandung. Education and interpretation of tourist attractions through disaster literacy is an added value for tourists during their trip and can support disaster risk reduction. This study aims to design a disaster-based geotourism route in the North Bandung Area. The research was carried out for eight months in 2021 in the North Bandung Area. A qualitative approach to this research with primary data acquisition through observation and interviews, while secondary data were obtained through policy documents related to disaster and tourism. The data obtained were then investigated with content analysis, map analysis, and descriptive analysis. The results showed two geotourism trail in the North Bandung Area, including geotourism routes in the Tangkubanparahu disaster-prone area and the Lembang Fault. In addition, disaster literacy was also identified in each geotourism route.

Keywords: Disaster literacy, Disaster-prone area, Disaster risk reduction, Geotourism trail, Sustainable tourism.

1. Introduction

North Bandung Area is a protected and cultivated area that has an important function and role in ensuring the sustainable development of life in the Bandung Basin Area. On the other hand, North Bandung Area has high potential to be developed as a tourism area [1, 2]. Referring to the Regional Regulation of West Java Province, Indonesia, No.1 of 2008 concerning the Control of Space Utilization of the North Bandung Area, the development of tourism in the North Bandung Area is utilized for ecotourism, agrotourism, educational tourism, and sports tourism activities. In addition, the North Bandung area is also a geological natural disaster-prone area that includes volcanic disasters, landslides, and earthquakes. Natural disasters are at the center of tourist activities, including in Tangkubanparahu, Ir. H. Djuanda Great Forest Park, Lembang area, and Dago area [3-6]. Nevertheless, the North Bandung Area has become a national priority area through its designation as a National Tourism Development Area in the 2010-2025 National Tourism Development Master Plan, namely the Tangkubanparahu and Lembang National Tourism Development Areas.

The high activity of tourists in the North Bandung Area is accompanied by the risk and vulnerability of tourists to geological natural disasters. The increase in the number and activity of tourists is due to the attractiveness factor in tourism destinations that have a greater risk of disaster [7-10]. Biodiversity and geodiversity of tourism destinations tend to be due to unique geological processes and forms that have a very close relationship with vulnerability and risk of natural disasters [11-14]. To reduce disaster risk for tourists, local governments and destination managers need to educate through disaster literacy activities that aim to ensure that all tourists understand what to do when a disaster occurs while traveling [15].

Previous research stated that disaster literacy is needed as a measure of disaster risk reduction and has a positive impact on local communities and tourists [16, 17]. Disaster literacy can be applied through various media and information and can be implemented through guiding in geotourism routes [18-20]. Geotourism is a form of disaster literacy implemented through interpretive facilities that are able to improve the tourist experience and trigger them to learn it [21, 22]. These goals can be met in various ways in various destinations, especially in geotourism attractions that have a level of significance for learning and knowledge dissemination [23].

North Bandung Area as a destination with a certain level of disaster risk is still one of the main destinations for tourists visiting Bandung [24, 25]. As an effort to disaster risk reduction, the design of geotourism routes in the North Bandung Area has the opportunity to minimize the level of vulnerability of tourists, also educate them and provide more value through experience while exploring geotourism routes. This study aims to design a geotourism route in the North Bandung Area based on the characteristics of the disaster.

2. Methods

The qualitative approach used in this research focuses on disaster literacy through geotourism route planning in the North Bandung Area. The research was conducted for twelve months starting in April 2021 to March 2022 and the subjects include tourist attraction managers and tourism experts, geologists, and disaster experts. The type of data used in this study is qualitative data obtained through online

observations and interviews with selective participants. The data were obtained directly to the subjects regarding disaster literacy and geotourism attraction by conducting observations, positioning, and documentation. Primary and secondary data sources refer to the research objective, namely designing disaster-based geotourism routes. The data source for designing geotourism routes refers to the thematic tourist route concept, including gateway, staging area, and tourist attraction clustering [26]. Geotourism attraction is interpreted using the concept of a geotourism box which includes process, form, tourism, geobasic, geohistory, and geo+ [27-29]. Meanwhile, the disaster literacy framework includes disaster knowledge, disaster attitudes, and disaster skills [30].

The primary data were obtained through observation in providing an assessment of tourist attractions and semi-structured interviews. Informants were selected through the purposive sampling technique by selecting certain samples specifically. In-depth online interviews to dig up information such as plans for developing geotourism attractions, disaster literacy, and characteristics of the research area. In addition, the positioning of satellite-based spatial elements was also carried out using Global Positioning System technology in determining the coordinates of tourist attractions in designing geotourism routes for the North Bandung Region. Furthermore, the secondary data collection method is in the form of disaster literacy and geotourism development which is carried out through a desk study that aims to obtain data and information from various policy documents, literature, and previous research on disaster literacy and geotourism route planning.

This study employs quantitative analysis, content analysis, map analysis, and qualitative descriptive analysis methods. The qualitative analysis used to analyse the respondent's perspective regarding disaster literacy in the North Bandung Area through online interviews, observation, and documentation. In designing geotourism routes, the data and spatial information obtained are then processed for data input, data management, as well as plotting and data conversion using geographic information system software (Esri ArcGIS and Google My Maps) and graphic design software (Adobe Illustrator). The stages of data analysis were carried out using secondary analysis methods which included data analysis before being in the field, data reduction, data presentation, and concluding.

3. Results and Discussion

3.1. Disaster literacy in the North Bandung Area

The complexity of the geological structure makes the North Bandung Area a high level of vulnerability to the threat of natural disasters. Sources of geological disasters in the North Bandung area that need to be considered are active volcanoes and active faults. Therefore, the geological environmental hazards that often occur in the North Bandung area include volcanic eruptions and lava flows, earthquakes, and landslides. In addition, there are other sources of non-geological disasters, namely the high intensity of rainfall which can trigger landslides and floods. Geological disaster-prone areas in the North Bandung area include areas prone to volcanic disasters, areas prone to earthquakes, and areas prone to landslides.

Mount Tangkubanparahu is one of the sources of volcanic geological disasters in the North Bandung area. The disaster-prone location of Mount Tangkubanparahu includes 1) Disaster Area I, which has the potential for lava flowing into the North

Bandung area through the Cimahi and Cikapundung sub-watersheds; 2) Disaster Area II, has the potential to be affected by hot cloud flows, lava, and rain lava with a radius of up to 5 km; and 3) Disaster Area III, has the potential to be affected by hot cloud flows, lava, and toxic gases with a radius of 1 km.

Earthquakes are part of a geological disaster that causes natural disasters such as landslides. The Lembang Fault is the main source of earthquakes in the North Bandung area. The risk of an earthquake is indicated by the strength of the earthquake, the depth of the earthquake, the distance from the epicenter, geological conditions, population density, and infrastructure. Faults are cracks in the earth's crust that have displaced the blocks it separates [24]. The Lembang Fault is a 29 km long crack that runs from the east (Mount Palasari, Cilengkrang District, Bandung Regency) to the west around Ngamprah District, West Bandung Regency. Earthquakes due to the Lembang Fault activity were recorded to have occurred in 1834, 1879, 1919, 2003, and 2011 with a strength of about 3 on the Richter scale [31]. In general, the earthquake category in the North Bandung area is classified as a medium and high earthquake-prone area. The western part of the Lembang Fault area is included in an area prone to medium earthquakes. The area has the potential to be hit by earthquake shocks so that there is the potential for soil cracks, liquefaction, landslides in hilly topography, and small-dimensional soil shifts. Meanwhile, the eastern part of the Lembang Fault is in a high earthquake-prone area that has the potential to be hit by earthquake shocks with an intensity scale of VII-VIII MMI. In addition, this area is located close to the source of the earthquake with a shallow depth.

Landslide is the movement of slope-supporting material in the form of rock, debris, soil, or mixed materials that move down or out of the slope [32]. Landslide susceptibility is classified into four zones, but in the North Bandung area there are only three zones, including 1) a low landslide susceptibility zone, an area that has a low level of vulnerability to landslides which generally occur if there is no disturbance on the slopes. This zone is evenly spread throughout the North Bandung area; 2) medium landslide susceptibility zone, has a medium level of vulnerability to being exposed to ground motion. In this zone, soil movement can occur, especially in areas bordering river valleys, cliffs, or if the slopes are disturbed. This zone is partly Lembang, West Bandung Regency, and Cimencyan and Cilengkrang, Bandung Regency; and 3) high landslide susceptibility zone, in this zone landslides often occur, while old landslides and new landslides are still actively moving, due to high rainfall and strong erosion. This zone is spread out along the flow of volcanic lava or rivers in the North Bandung area, namely the Cimahi River and the Cikapundung River.

3.2. Disaster-based geotourism routes in the North Bandung Area

The development of a disaster-based geotourism route first needs to be inventoried of tourist attractions based on three main classifications. After the tourist attractions are classified, the next step is to determine the geotourism attraction which refers to the concept of the geotourism box, and the geotourism route which refers to the disaster-prone areas in the North Bandung Region.

Geotourism is a tourism product based on geological and geomorphological elements whose processes and forms are the main resources in attracting tourists. Understanding of tourists on geotourism attraction can be done through

interpretation. An interpretation that focuses on geological aspects can create tourist satisfaction and contributes to conservation [33]. Tourist attractions reinterpretation in the North Bandung Area is needed to assess them as a geotourism attraction [25]. The tourist attraction assessed is a tourist attraction that is classified as having geological diversity, so it is called a geotourism attraction. Meanwhile, biological and cultural-based tourist attractions are classified as geotourism supporting tourist attractions.

There are 17 geological-based tourist attractions as seen in Fig. 1, seven of which are interpreted separately because of their uniqueness, including 1) Curug Cimahi, the process of formation of the earth's crust as a result of volcanic activity from Ancient Sunda Mountain; 2) Mount Batu Lembang which was formed by lava resulting from the great volcanic activity of Mount Sunda Ancient 500,000 years ago; 3) Mount Tangkubanparahu, previously known as Mount Sunda Purba which erupted about 105,000 years ago and spewed millions of cubic meters of material in the earth, resulting in a void of space in the earth, so that the earth's surface collapsed and the large caldera of Mount Sunda was formed which gave birth to Mount Tangkuban Parahu; 4) Curug Dago results from the eruption of Mount Tangkubanparahu material in the form of magma and flows as ancient basalt lava into the valleys in all directions around 125,000 - 48,000 years ago, with a temperature of 5000C; 5) Batik Stone, which is magma and lava from the eruption of Mount Sunda Purba which flows from the Cigulung River and then meets the Cikapundung River to form Pahoehoe Lava; 6) Tebing Keraton, a stretch of straight-slope fault with a straight slope wall facing north as a result of the shift of the earth; and 7) Mount Palasari, Tectonic cracks in the earth's crust that extend more than 22 km (Padalarang - Cilengkrang) have shifted the northern block (Lembang-Maribaya-Cibodas) which is moving relatively downwards and the southern part (Dago, Cigadung, Cimenyan) is uplifted.

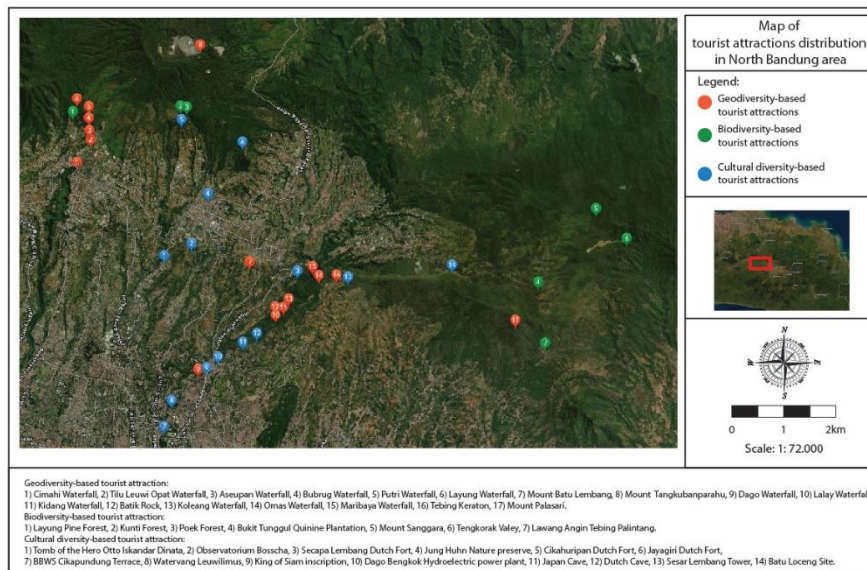


Fig. 1. Map of the distribution of tourist attractions in the North Bandung Area.

Meanwhile, ten other geological-based tourist attractions are interpreted in groups because they have the same process and form from a geological aspect. Geotourism attractions include 1) Curug Tilu Leuwi Opat, 2) Curug Aseupan, 3) Curug Bubrug, 4) Curug Putri, and 5) Curug Layung which has the process and shape of the lava flow resulting from the eruption of Mount Sunda Ancient which can be seen from the shape of the waterfall. rock in the wall area; 6) Curug Lalay, 7) Curug Kidang, 8) Curug Koleang, 9) Curug Omas, 10) Curug Maribaya which is the path of the eruption of Ancient Sunda Mountain which can be seen in hollow basalt rock which is generally black and rough with a frozen vesicular texture, forming a steep wall, then passed by river water and formed several waterfalls.

After mapping out the geotourism area, the next step is to design a geotourism route that refers to the distribution of tourist attractions, accessibility, and physical characteristics of disaster-prone areas. There are two geotourism trails, including the Geotourism trail in Volcano Disaster Prone Area and the Geotourism trail in the Lembang Fault Earthquake Hazard Area. Each of these geotourism trails has two geotourism routes, namely Ci Mahi Geotourism Route, Lembang-Tangkubanparahu Geotourism Route, Ci Kapundung Geotourism Route, and Lembang Fault Geotourism Route. The Tengkorak Valley Landslide Hazard Area is classified as a geotourism route due to the limited tourist attraction and scope.

In Fig. 2, the map of the Disaster-Based Geotourism Path in the North Bandung Region has three different delineations or disaster-prone areas with an orange line as a geotourism route. The red delineation is a geotourism route based on volcanic disaster, it has two routes starting from Cimahi Waterfall to Mount Tangkubanparahu. The green delineation is a Geotourism route based on the earthquake caused by the Lembang Fault north of Bandung City or south of Lembang. The last one is the blue delineation with the Geotourism route with the Landslide disaster in the Bukit Tunggul Area. Each area or delineation certainly has a diversity of potential tourist attractions. At each delineation, there are tourist

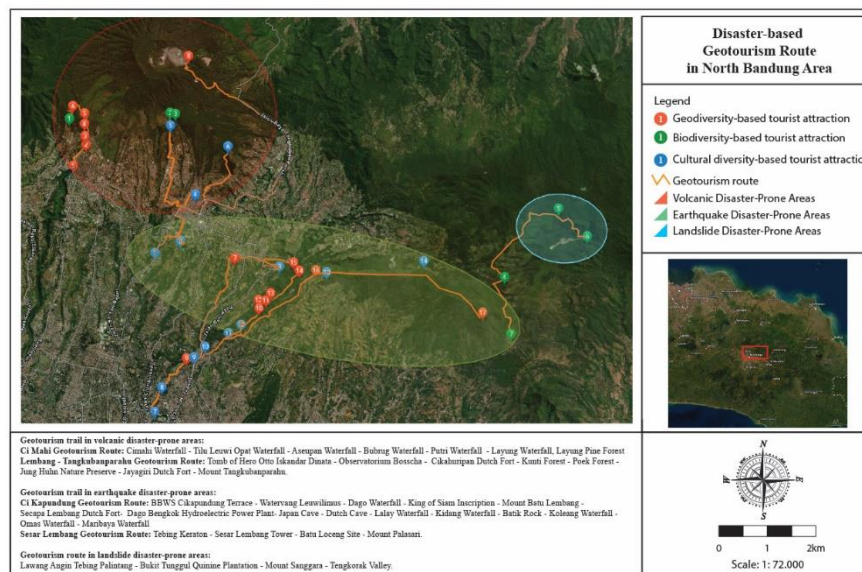


Fig. 2. Map of Disaster-based geotourism route in North Bandung area.

attractions that have different meanings. Tourist attractions are divided into three types, the red colour is a tourist attraction caused by geological activity, a tourist attraction whose biodiversity is shown in green, and the blue colour is a tourist attraction that has cultural value. The three delineations were formed on the different potential disasters in each region.

The Geotourism trail in the Tangkubanparahu Volcano Disaster Prone Area is a destination based on the Volcano disaster. This Geotourism area is divided into two routes which are distinguished based on the geological process. The Ci Mahi Geotourism Route is a route that has geodiversity and biodiversity tourist attractions from the eruption of Ancient Sunda Mountain, including Cimahi Waterfall, Tilu Leuwi Opat Waterfall, Asepun Waterfall, Bubrug Waterfall, Layung Waterfall, and Layung Pine Forest. The river flow was formed by the lava of the Ancient Sunda Mountain. This route is also known as Ci Mahi River Trek. This is evidenced by the presence of igneous rocks on the walls of the Ci Mahi River. This river flow is fed by water that comes from upstream in Situ Lembang, at the foot of Mount Burangrang. The second route is a route formed based on the heritage of the Dutch, the graves of national heroes, and natural tourist attractions. The second route starts from the Tomb of Heroes Otto Iskandar Dinata, Boscha Observatory, Cikahuripan Dutch Fort, Kunti Forest, Poek Forest, Jung Hunh Nature Reserve, Jayagiri Dutch Fort, and Mount Tangkubanparahu.

The Geotourism Trail in Lembang Fault Earthquake Prone Area has two routes based on geodiversity and biodiversity attractions. This area is at risk because it has the potential for an earthquake disaster if it occurs. The first route starts from Tebing Keraton to Mount Palasari is part of one-third of the total length of the fault. If a disaster does occur, the earthquake is destructive, including an impact on the power of tourist attractions around it. The second route starts from BBWS Cikapundung, is chosen by following the Ci Kapundung River then passing through the irrigation from the Dutch or Watervang Leuwilimoes, then heading to one of the waterfalls located in Bandung City with the History of Inscriptions from the Thai Nation. The route continues towards Mount Batu which is part of the Lembang Fault and ends with the Ir. H. Djuanda Forest Park. This Ci Kapundung Geotourism route is also called a Ci Kapundung River Trek because trekking activities are carried out by walking along the river.

Geotourism in Tengkorak Valley Landslide Disaster-Prone Area is still part of the Lembang Fault area but is divided based on the disaster risk. Lawang Angin Tebing Palintang is located between the foot of Mount Manglayang and the foot of Mount Palasari (Edge of the Lembang Fault). In Sundanese language, Lawang means door, thus Lawang Angin is the entrance of wind from North (Lembang) to South (Bandung) or vice versa. Continued to the medicinal plantation of the first Malaria disease, namely the Bukit Tunggul Quinine Plantation. The Tengkorak Valley is an area formed by the landslide of the cliffs of Mount Pangparang. The name of Tengkorak Valley, the name given was not as scary as his name. Around the location, you can find a naturally formed lake behind Mount Sanggara.

4. Conclusion

The North Bandung area is designated as a protected area by West Java Province because it is vulnerable to volcanic disasters, earthquakes, and landslides. On the other hand, the North Bandung area has a variety of tourist attractions, both based on

geology, biology, and culture, making it the main destination for tourists. The high number of tourist visits is also supported by the designation of the Tangkubanparahu area as a National Tourism Strategic Area and the Lembang area as a National Tourism Development Area. The high tourism activity and the large potential for disaster in the North Bandung area can provide added value for tourists through disaster education during geotourism activities. Geotourism can provide interpretation and education for tourists about the disaster conditions in the North Bandung Area, this is because the disaster-prone area in the North Bandung area is classified as a geological disaster-prone area. Through the development of geotourism routes in each disaster-prone area, it is able to provide input for tourist attraction managers and local governments to implement disaster management programs. This has the opportunity to provide a sense of security and comfort for tourists during their tourism activities in the North Bandung area. The three main disaster-prone areas in the North Bandung area require a disaster information center to be placed each disaster-prone area. It can be implemented and integrated with a tourism information center. In addition, the need for interpretation boards at each geotourism attraction can help individual travellers (self-guided). It is recommended that Further research identify the role of local communities for the development of geotourism routes in disaster-prone areas, both from structural and non-structural aspects as an effort to prepare for disasters in tourism areas.

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