Feasibility study and resilience disaster assessment toward shelter and settlement areas in Rinjani circumference, Sembalun district, East Lombok, West Nusa Tenggara Province

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Abstract. Rinjani is one of the active volcanoes in the province of West Nusa Tenggara, Indonesia. In 2018, Rinjani designated as world geopark by UNESCO. Mount Rinjani has regional support Rinjani potential as a world geopark, which Rinjani circumference. This study aims to assess feasibility and disaster resilience towards shelter and settlement in Rinjani circumference. This study uses qualitative descriptive analysis by examining building physical elements and the environment. Based on the identification, it is necessary to organize shelter and settlement resilient among other things: 1) Land Use, is planning disaster vulnerability zones, emergency response settlements, and protected areas, and public facilities in safe zones, 2) Shape and Building Mass, is adjusting environment and local wisdom, climate and context, household and livelihood activities, occupancy problems, construction materials, construction activities, participatory design, venting and vector control, 3) Circulation and Parking, is integrating circulation paths with evacuation routes, assessing access, security and safety of local settlements, road infrastructure and artificial lighting requirements; 4) Open Space, is preserving sustainability, functions, and environmental value as the world’s geopark region; 5) Supporting Activities and Signages, is making signage indicating route, tourist activities location, processing activities of agricultural and plantation as well as informative evacuation.

1. Introduction

The Rinjani circumference region in Lombok island is one of the destinations of the world which has been designated by UNESCO as a World Geopark area (UNESCO Global Geopark). The volcano located on the island of Lombok, West Nusa Tenggara province has Rinjani Lombok Potential Geopark of which have been identified, which consists of twenty-two sites Geology (GeoHerritage), eight sites Biology (BioHerritage), and seventeen cultural sites (CultureHeritage). The potential is dispersed and at some point the location of shelter, settlements and the environment in some areas.

In reference [1], is an event of the disaster, natural or humanmade, suddenly (progressive), which causes a devastating impact that the affected community or society or affected must respond with action outstanding. In the Spatial Plan of East Lombok years 2012 - 2032, Sembalun District defined as an area of geological disasters. In 2015, affected by the volcanic mountain Barujari exhausts. In 2017 Sembalun District flash floods. Based on data collected from Sembalun District of six villages affected by floods, there are six houses damaged, eleven moderately damaged, three hundred sixty-seven lightly damaged, two units house fire, house foundations undermined two and two units of houses were washed away.
The house is a refuge from the outside human influence, such as climate, enemies, and diseases. Every human being has the right to adequate housing [2]. In reference [3] there are five essential elements of settlement: Nature, is a land that can be used to build houses and other function, Human, both personal and group building or residence; Society, in which there are interactions between human and social relationships so as to form a specific bond as a community; Shell, which is building a human dwellings with their respective functions; Networks, in other words the infrastructure to support environmental functions both natural and man-made.

In terms of building or dwelling from residents of the area around the circumference Rinjani region, particularly in rural areas, functioned as a place of refuge, a place to move and socialize as well as businesses that support the potential geopark. Conditions settlements characterized by traditional architecture and tropical partially still in a stateless feasible, both from the aspect of architecture, structure and aesthetics, including the level of disaster resilience of the structure and the material used for the lack of public understanding of the home is worth and resilient, especially the area around hills, mountains or mountain. In reference [4] there are physical elements, namely land-use design, shape and mass of the building, circulation and parking, open space, pedestrian paths, support activities and bookmarks.

2. Method
In this research, the approach is through a qualitative approach, where the dominant data collection techniques derived from interviews, field notes, personal documentation, notes, memos, and other official documents. The purpose of this qualitative study describes the empirical reality behind the phenomena in-depth, detailed and complete. This study specifically examined the building and environments, using the overlay technique to determine the area included in disaster areas.

3. Results and Discussion
3.1. Identification Physical Elements
Under the existing conditions that existed at the shelter and settlements in the area of geopark corresponding physical design elements can be identified as follows:

3.1.1. Land Use
Sembalun land area in the district amounted to 216.61 hectares with the use of land for cultivation area, namely rice fields, building or yard by 57 percent and protected areas, namely legal or garden and others by forty-three percent. Land used for shelter areas and the other awoke still low. The land use is dominated by plantations, especially plants that support the potential of biodiversity, such as strawberries, tomatoes, potatoes, and so on competitive commodities from sub-Sembalun.

Sembalun district has a function designation as cultivation areas and protected areas. The cultivation area comprises shelter, agricultural, commercial and office buildings. While the protected area consists of plantations and forests. Rinjani circumference region as a world geopark has the potential distribution in the district geo product Sembalun include geo culinary, geo homestay and geo souvenir located in shelter areas. The buildings are not only used as a shelter function but also businesses. While geotourism is located at the distribution point natural tourist sites are located in protected areas, either in the form of hills, valleys, waterfalls, and more. The designated condition and the distribution area in the Sembalun District geo product potential can be seen in Figure 1.

In the Spatial Plan of East Lombok years 2012 - 2032, Sembalun District defined as an area of geological disasters. Hazard maps of the region and protected cultivation, including geo product distribution more clearly seen in Figure 2.

Based on Figure 2, it can be seen that the sub-Sembalun Districtexperiencing the potential hazard to the flow of material destruction, the movement of soil medium, high ground movement, tsunami, and river flood. Some of the potential disasters hit on cultivated areas and protected areas over which the settlement and distribution geo product.
3.1.2. Shape and Mass Building

Building in Sembalun district consists of buildings that functioned as a shelter and business, such as homestay, commercial and household industries. The shape of the building uses traditional architectural features typical local tropical with most using the stage structure. The buildings using local materials and mostly located along the road and a small portion in the hills and along the river. These buildings using local materials and environmentally friendly housing is intended to adjust to the climatic conditions in Sembalun. A condition of the building with a shelter function and homestay in Sembalun can be seen in Figure 3 and Figure 4.

Figure 3 shows the homestay and the surrounding neighborhood that has integrated with the natural landscape and the use of environmentally friendly local materials with characteristics of tropical architecture building. Figure 4 shows the housing with a traditional tropical architectural feature with the use of local materials environmentally friendly structures and building houses on stilts low.
The location of settlements located in a valley surrounded by hills with an altitude of 800 to 1200 meters above sea level. The settlement pattern is linear along roads and centralized in two locations administrative center but not organized regularly. Building density in Sembalun district is low, five percent spread over administrative area with the distance between buildings between five to ten meters. The orientation of the building facing the road and leads to Mount Rinjani. Thus efforts should be made to the housing arrangement in Sembalun because most of the occupancy is in areas prone to natural disasters. The map layout and orientation of buildings in the Sembalun district can be seen in Figure 5.

![Figure 5. The map layout and orientation of buildings in the Sembalun district.](image)

3.1.3. Circulation and Parking
Sembalun circulation patterns in the district itself consist of circulation that connects the Sembalun district with the surrounding district, where circulation is influenced by the presence of collector roads and local roads that serve as community liaison activities in Sembalun follow condition of contour and landscape. For the parking pattern in the district Sembalun district still utilize the community settlement to support tourism activities.

3.1.4. Open Space
With a low level of building density, namely, reach ten percent of the area, where the open space can optimally support the function room for shelter, settlement, and other designated functions. Most are protective vegetation and cover the open space to enhance the ability to carry capacity environment and provide a visual aesthetic value.

3.1.5. Supporting Activities and Signage
Supporting activities in Sembalun consists of tourism and agricultural activities, tourism activity itself consists of artificial nature and travel, while for the processing of agricultural activities of agricultural and plantation. Signage that describes identity and activities in Sembalun district has not found.

3.2. Structuring Shelter and Settlements
Structuring Efforts to manage shelter and settlements in disaster-prone areas are carried out as mitigation related to the following physical elements

3.2.1. Land use
Land use planning for shelter areas properly must be conducted with respect to each zone of disaster vulnerability, such as the zone of debris material flow and occupancy that is built to be within 50 meters of the river banks; zone potential ground movement being permitted to build settlements on the condition of houses on stilts and the selection of the type of low buildings and preserving the environment; zones of high potential ground movement is done with the relocation and engineering for slope; potential river flood zones, with occupancy, must awaken within fifteen meters of the river banks.
Land planning is also done for the settlement of emergency response, with planning of land for shelter communities while taking into account the social practices that exist and the shared use of resources, including water and sanitation with an assessment of the sewer line of surface water and the risk of inundation or flooding, the slope of the land should not be more than six percent; shelter areas and camps for planned or spontaneous, shall be made available extent feasible surface area at least 45 square meters per person; vector risk for temporary community settlements is a major control effort in reducing the impact of vector-borne diseases on affected populations and the safety of fires requiring a 30-meter area for firebreaks separating every 300-meter building space and at least two meters between occupancy.

While land-use planning for protected areas must always be maintained continuity, even can also be added to the protective vegetation planted as a barrier to erosion and as a barrier to the cultivated area in the vicinity. Placement of public facilities in the safe zone and should be connected directly to shelter areas and other public buildings to facilitate achievement.

3.2.2. Shape and Building Mass
For the use of shelter space and housing with care for the environment and local wisdom as well as some aspects as disaster mitigation efforts, namely: 1) Climate to consider a range of extreme climate-related, the shape of occupancy must conform climate characteristics that exist at the site, maximize ventilation and minimize entry of direct light sun, the roof has a slope that is sufficient to provide channels for rainwater except in locations vulnerable to high winds, shelter construction in the form of lightweight construction, adequate surface water channels and the use of the raised floor height; 2) Troubleshooting occupancy, building materials and construction, for example, a family tent or building package ready for installation with the building materials must meet the specifications and national and international standards as well as technical and financial capabilities residents should be according to the specifications of materials and technology used and regular monitoring; 3) The design of a participatory, everyone must understand the advantages and disadvantages of forms of construction that are used in determining the type of shelter assistance will be provided; 4) Ventilation and vector control, providing adequate ventilation in the dwelling individual households and public buildings. In addition, consider the need for vector control efforts in building use, occupancy patterns of use by the displaced population and the selection of building materials.

While the arrangement of the layout and settlement patterns as well as the orientation of buildings adapted to each zone or building settlements, namely: 1) Building along the road, facing the road with regard to the building demarcation line; 2) The building along the banks of the river, overlooking the river with regard to the demarcation line of the river; 3) Building on the hills, with levels slopes minimum of fewer than thirty degrees and not in watersheds and away from cliffs to avoid the occurrence of landslides. It is also necessary to build retaining walls around the building; 4) Building on the waterfront, on a regular settlement patterns, parallel to the direction of propagation and tsunami tidal waves or perpendicular to the coastline, the wide side of the building is made parallel to the coastline, thereby reducing the water pressure and the tsunami tidal waves and monsoons hit the building which is the shortest side of the building perpendicular to the beach with the sea and the orientation of the circulation path. The location of settlements must further towards the most vulnerable zones of extreme waves, a minimum setback of hundred meters or with a radius of more than two hundred meters from the beach; 5) Side width should be perpendicular to the direction of the wind, to reduce the widest field of building. Regularity and parallel position of the building with the landscape and corridor reduces water pressure and winds that hit when a disaster occurs. The location of settlements must further towards the most vulnerable zones of extreme waves, a minimum setback of hundred meters or with a radius of more than two hundred meters from the beach.

3.2.3. Circulation and Parking
Some things should be done in circulation are: 1) Arrangement of the circulation path must adapt and integrate with the planned evacuation route when a disaster occurs, easy access to housing, infrastructure conditions, and sufficient conditions much nearby center - the transport hub for emergency response support; 2) For the settlement temporary community, the locations used and dots stock primary relief goods must be accessible by heavy trucks from the roads impassable in all types of seasons and to avoid
the access point and an exit point which makes the emergence of regional isolated or limited to threaten the personal safety of its users; 3) Great trails and paths made in the settlements must provide secure access, ensure safety,

3.2.4. Open Space
In the presence of an open space consisting of field, garden, rice fields, plantations, and protected areas need to continue to be preserved by keeping function and environmental values of protected areas as part of a world geopark region.

3.2.5. Supporting Activities and Signages
Some things should be done on support activities, and signages are: 1) Making the signage consisting of hard signage and e-signage indicating the route and location of tourist activities and processing activities of agricultural and plantation as well as informative evacuation; 2) Preparation of signage to indicate the identity of the geopark area location is attractive and comfortable to see, and 3) Hard signage material should use natural materials.

4. Conclusion
Based on research that has been done it is necessary referrals towards shelter and settlements feasible and disaster-resilient as follows:
1) Land Use, with due regard to each zone of disaster vulnerability, planning for the settlement of emergency response, planning land use for the protected areas by maintaining sustainability, as well as the placement of public facilities that should be in the safe zone and is directly connected to shelter areas and other public buildings to facilitating the achievement.
2) Shape and Building Mass, with attention to the environment and local wisdom as well as some aspects of disaster mitigation efforts, taking into account the climate, household activities, and livelihood. While the layout and orientation of buildings is done by laying and settlement patterns as well as the orientation of buildings adapted to each zone settlements or buildings including attention to building orientation concerning the shape of the building and the direction toward the building
3) Circulation and Parking, with arranging the corresponding circulation path and integrated with the planned evacuation route when a disaster occurs, the assessment regarding access, security, and safety of the settlements and the condition of the local road infrastructure, including the need for artificial lighting.
4) Open Space, preserve the continues, functionality, and environmental values of protected areas as part of a world geopark region.
5) Support Activities and Signages with the provision of signage is using natural materials.

5. Suggestion
It takes several simultaneous and integrated efforts of all parties to continue to be active and participate in maintaining the existence of shelter and settlement resistant and worthy to disasters in the region as a destination region Rinjani circumference world geopark. Involve an and provide insight to the public and all interested parties about the urgency of decent shelter and settlement and resilient as mitigation and development potential of world geopark that responds to disasters.

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