Green Tourism Planning for Coastal Development in Gunungsewu Geopark, Indonesia

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Abstract

Having spectacular views of the karst landscape area, Gunungsewu Geopark (GG) has increasingly become a popular tourist area in the southern part of Java Island, Indonesia. With a significant increase in tourist visits and tourism development along the beaches area, the fragile environment of GG is severely threatened. This study aims to propose a design of green tourism planning in the coastal area of GG. We collected data through in-depth interviews, brainstorming, expert meeting, and focus group discussions with the key informants representing all stakeholders. The results show that GG could be grouped into two clusters to develop coastal green tourism namely cluster 1 that can be developed as public tourism and cluster 2 that can be focused on natural landscape preservation. Furthermore, seven recommendations are proposed to be carried out in the future in order to develop sustainable tourism in GG.

Keywords: Coastal Area, Gunungsewu Geopark, Karst, Sustainable Development, Tourism

1. Introduction

Gunungsewu, which means a thousand mountains, is the largest karst area in Java, Indonesia covering about 1,300 km^2 area and plays important roles locally, nationally, and regionally in water supply, agriculture, mining, and quarrying, tourism, as well as biodiversity conservation [1] [2] and [3]. With unique morphological characteristics of thousands of conical hills formed since the Miocene age, in 2015 Gunungsewu was acknowledged by UNESCO as a part of the Global Geopark Network (GGN), which later popular as Gunungsewu Geopark (GG). According to UNESCO, GG is a classic tropical karst landscape dominated by limestone of the Neogene age and consists of calcareous-tuffaceous clastic facies (Oyo and Kepek formations) as well as reef facies (Wonosari formation). The Late Oligocene to Early Miocene rocks of volcanic-origin clastic, volcanic, and marine sediments underlie these limestones and have formed quaternary river and lake deposits. In addition, GG is a tectonic active area since it is in front of an active subduction zone between the Indian Ocean, Australian and Eurasian plates, resulting in active uplifting and producing very visible river and coastal terraces along the southern coast of the GG.

Having spectacular views of the karst landscape area, GG is a well-known tourism area in the southern part of Java Island, Indonesia. The caves with beautiful stalactite and stalagmite, white sand beaches that stretch for around 82.84 km in length, vertical cliffs along the seashore, and spectacular landscape views have become the new tourism objects in GG [4]. Lately, several tourist destinations sites in GG, in particular beaches sites, have attracted hundreds of thousands of tourists visit every year, namely Ngobaran, Ngrenehan, Baron, Kukup, Krakal, Sepanjang, Sundak, Pulang Sawal, Seruni, Ngunggah, Celeng Tibo, Wediombo, Siung, Jogan, Sadeng, and others. With a significant contribution to the local and regional revenue, this tourism sector has become the focus of development from the authorities i.e., Gunungkidul Regency government and Yogyakarta Special Province government. With a significant increase in tourist visits and tourism development along the beaches area, the fragile environment of GG is severely threatened. This is in line with the findings from [5] that tourism in karst may result in huge impacts on the environment because of the relative fragility of the landscape, and even eco-related activities [6].

Faida and Marhaento [2] found that anthropogenic activities such as land developments to meet tourism demand in the karstic areas may result in the extinction of native plant species. The waste disposal from tourism activities can pollute allogenic rivers and karst ponds resulting in environmental damage to riverine ecosystems [7]. All these anthropogenic impacts will further exacerbate already at-risk and vulnerable ecosystems of karst due to climate change [8].

Considering an increasing trend of tourism resource excessive development which potentially results in worsened ecological environment quality, it is necessary to develop a more sustainable development of the tourism industry in GG. This is also to seize the opportunity to capture the emerging market demand for "eco-friendly" tourism [9]. However, in fact, eco-friendly tourism either in theory or in practice is often confused especially in the environmentally fragile areas and the culture-sensitive areas as in a karst area [10]. This study aims to propose a design of green tourism planning in GG, Indonesia. We specifically chose the beach tourism sites along the coastal area of GG for the study due to the massive tourism development in the last decade. This study will provide insight on how to develop sustainable geo-tourism in a fragile ecosystem based on a stakeholder participatory approach. This is so far still lack of studies worldwide focusing on it, especially for a karst area, requiring further studies.

1.1 The Concept of Green Tourism in Karst Area
The concept of green tourism or often called ecotourism as discussed by [11] [12] [13] [14] [15] and [16] is mainly concerning of three key factors, namely conservation, communities, and sustainable travel. By this means, ecotourism is defined as a responsible journey to natural areas that conserves the environment while improving the well-being of surrounding local communities [17]. In terms of ecotourism in the karst area, tourists should be responsible for the sustainability of the karst environment including geological phenomena (e.g., landforms, rock outcrops, fossils, and minerals), biotic (e.g., plants and wildlife), and the local culture [18].

Green tourism in the karst area is a holistic approach. Developing karst green tourism planning should consider a wide spectrum of knowledge in order to achieve sustainable development. Furthermore, Winarno et al., [18] argue that green tourism in the karst area, which they called geo-

tourism, should deliver benefits as follows: a) improves the welfare of the people who live around them with the development of jobs and entrepreneurship for the local community. b) encourages the surrounding community to participate in maintaining and developing the object of geo-tourism. c) creates sustainable tourism development based on local wisdom. d) encourages visitors to appreciate the location of the geo-tourism object by geological aspect. e. gives impressions and experiences that are different from other tourist activities.

2. Study Area
Gunungsewu Geopark (GG) stretches over 85 km in the southern part of Java Island, starting from the Parangtritis Beach in Bantul Regency, Yogyakarta province in the west to the Teleng Ria Beach in Pacitan Regency, East Java province in the east. Administratively, GG covers three provinces, namely Yogyakarta, Central Java, and East Java Provinces, with an area of around 1,300 km^2 (Figure 1). This study focuses on the coastal area of GG, which is located in seven sub-Regencies with a total area of 530 km^2 or around 40% of the GG area. The average elevation of the area is 299 meters a.s.l., with Purwosari sub-Regency having the highest elevation (342 m) and Girisubo the lowest (215 m). The population in this area is 182,642 people with an average population growth rate of 1.1% per year [19].

The climate in GG is strongly influenced by monsoons, with a distinct wet season from October to April and a dry season between May and September. The annual rainfall varies between 1500 mm and 2,986 mm, while the mean annual temperature is around 27 °C [20].

2.1 Tourism in Gunungsewu Geopark
Currently, tourism development in GG is grouped into six Strategic Tourism Areas (STA), in which STA 1, 2, and 3 are in the coastal area, while STA 4, 5, and 6 are located on the mainland (Figure 2). In terms of tourist attractions, STA in the coastal area (i.e., beaches and surrounding) are more attractive and popular amongst visitors than KSP 4, 5, and 6 where the main tourist attractions are sinkholes or vertical caves. Data from the local authorities show that during the 2017-2019 period the average tourist visited Gunungkidul Regency of around 3,331,367 people per year, of which 99.4% were domestic tourists.
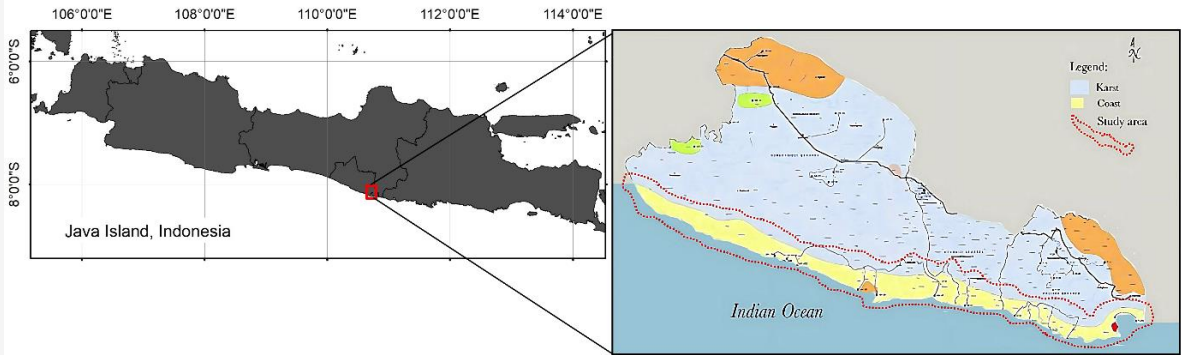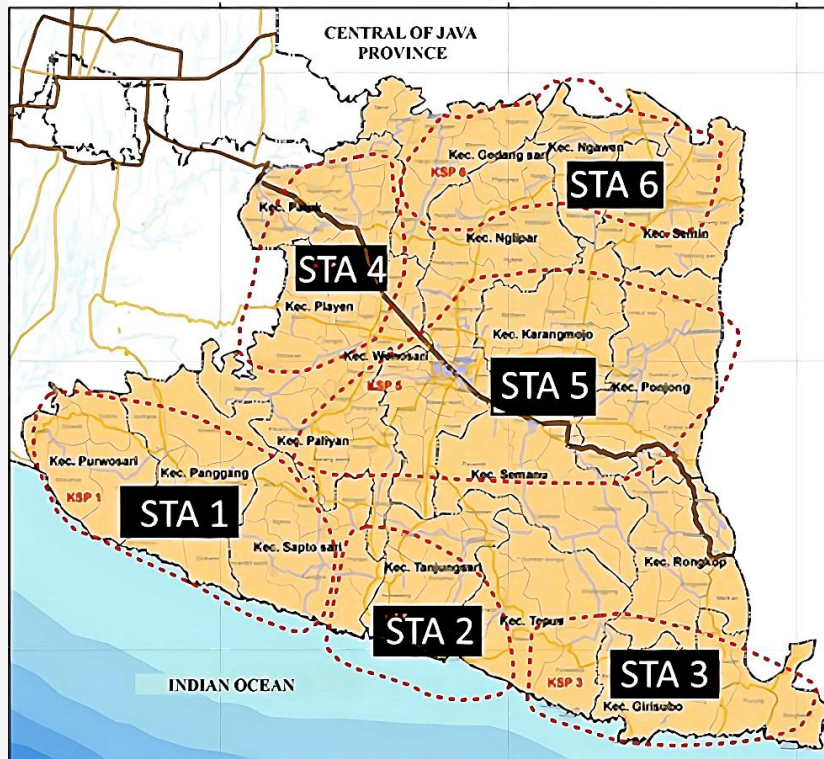
Figure 1: Location of the study area

Figure 2: Map of Strategic Tourism Areas (STA) in Gunung Geopark in Gunungkidul Regency

3. Method

3.1 Data Collection

In this study, spatial and non-spatial data were used. For the spatial data, we used the topographic map (i.e., Rupa Bumi Indonesia) at a 1:25,000 scale from the Geospatial Information Agency of Indonesia to retrieve information related to elevation, roads, and locations of public facilities (e.g., tourism sites, hospitals, schools, and offices), landform map and geological map at 1:250,000 scale from the Regional Physical Planning Project for Transmigration (RePPProT), and the latest spatial planning map at 1:50,000 scale from the Agency for Regional Development (BAPPEDA Gunungkidul). For the non-spatial data, regional planning documents from

the local authorities were documented and studied. This study collected data from both primary and secondary sources. Data collected from the primary sources were acquired from in-depth interviews, brainstorming, expert meeting, and focus group discussions with the key informants. In total, 200 key informants were involved in this study to provide information about the development plan for green tourism along the coastal area of GG. Table 1 shows the key informant from various stakeholders that provided information for the study. During the communication processes, the key informants were mainly asked about their opinions on how to develop green tourism in the study area.

3.2 Data Analysis
In order to analyse the collected data, we used a descriptive method using an inductive approach. In the inductive approach, we started with the observations and discussion with the key informants without providing preliminary theories [21]. For the spatial planning aspect, we carried out a participatory mapping using 2D scaled mapping technique with relevant stakeholders (Table 1). The 2D scaled mapping technique was conducted by plotting information acquired from the stakeholders to already existing basic maps of the area (i.e., topographic map), where the base map is serving only as background information [22].

Subsequently, the results of participatory mapping were linked into our GIS database to produce tourism plan development maps at a scale of 1:5,000 and 1:10,000. The design of green tourism planning in GG, especially along the coastal area, was spatially developed based on the tourism plan development, overlaid with the meso-scale topographic map (RBI map) containing information related to elevation, roads and houses was made available by the Geospatial Information Agency of Indonesia. This topographic map was used as a basis information of accessibility and feasibility the study area. In addition, Landsat 8 image of the study area (path 120, row 65) that are made available by the United States Geological Survey (USGS) archives

was used for assisting during reconnaissance visit to the study area.

To visualize the resulted green-tourism design, we used a three-dimensional symbol or 3D map. The 3D map uses a digital, mathematical defined, three-dimensional virtual generalised representation of a specific area to illustrate physical features. Finally, we generated the study conclusions (i.e., green-tourism design of the study area) after carrying out the public consultation to the stakeholders.

4. Results and Discussion
4.1 Re-clustering the Coastal Tourism Development
After intensive discussions with the key informants as listed in Table 1, it was agreed that the existing clusters of the coastal Strategic Tourism Areas (STA) need to be re-clustered considering the proximities, attractions similarities, accessibilities, physical properties (i.e., geomorphological type), and sociocultural conditions. Cluster 1 combines STA 1 and STA 2 consisting of Baron, Kukup, Sepanjang, Sanglen, Watu Kodok, Drini, Ngerumput, Krakal, Sadranan, Ngandong, Sundak, Pulang Sawal, Trenggole, Pok Tunggal, and Seruni beaches, while cluster 2 is belong to STA 3 consisting of Ngetun, Timang, Ngelambor, Siung, Watu Lumbung, Pesawen, Wediombo, Sedahan, Ngrungap, Srakung, Sadeng, Baronan, and Krokoh beaches (Figure 3).

Table 1: Key informants who participated in the study

Methods	Participants
Discussions	Officials at Ministry of Agrarian Affairs and Spatial Planning, Ministry of Home Affairs, Ministry of Tourism and Creative Economy, Ministry for Public Works and Human Settlements, Ministry of Marine Affairs and Fisheries, Ministry of Environment and Forestry, Indonesian Banking Association.
Brainstorming	planners, architects, geographers, geologists, anthropologists, civil engineers, environmentalist, biologists, speleologist, food experts, gastronomists, artists, and economists who are previously worked in the topic of green tourism.
Expert meetings	experts from various fields of science at universities in Indonesia (i.e., Universitas Gadjah Mada, Ambarrukmo Tourism Institute, Universitas Pendidikan Indonesia, Members of Indonesian Environmental Scientists Association (IESA), Indonesian Association of Urban and Regional Planners, Indonesian Economist Association (IEA), and Tourism actors.
FGDs	officials of Department of Agrarian Affairs and Spatial Planning of the Yogyakarta Special Region Government, Yogyakarta Special Region Tourism Office, Government of Gunungkidul Regency, Tourism actors consisting of officials at Indonesian Hotel and Restaurant Association, Association of Indonesian Tour and Travel Agency, Indonesian Tour Guide Association, Indonesian Tourism Objects and Attraction Organization, Indonesia Marine and Tourism Association, Indonesian Tourism Society, Hotel Human Resources Managers Association, and Indonesian Tourism Area Association; teachers from tourism education institutions, and local communities.

Figure 3: The result of re-clustering map that grouped into two clusters namely cluster 1 (i.e., combinations of KSP 1 and 2) and cluster 2 (i.e., KSP 3)

Beaches destinations in cluster 1 are predominantly formed by coastal erosion including cliffs, wave-cut platforms, caves, arches, stacks, stumps, and headlands, which are results of intensive erosional and solutional processes in the karst topography. The beaches' sand in cluster 1 has a wider area than in cluster 2 allowing tourists to come closer to the area and park their vehicles near the beach. However, tourism in cluster 1 tends to be spatially polarized having a segmented market so that between adjacent beaches destinations there is a tendency for product and price competition. Most of the beaches develop space-time attractions with a focus on adventure tourism like riding All-Terrain Vehicle (ATV), paragliding, wingsuit gliding, and water recreation such as fly-board and jet skiing. Most tourists in cluster 1 are young people (i.e., 15-25 years old) who are more concerned with recreation than seeking experiences or education. In addition, cluster 1 offers three destinations for snorkelling namely Sadranan, Watu Pecah, and Kali Senggoro beaches, although it can only be done near the shoreline since the sea waves are quite dangerous for tourists. Cluster 1 also provides socio-cultural tourism such as pilgrimages and traditional ceremonies, which currently invite thousands of tourists to attend per year. Here, tourists can also order seafood from the locals and then cook it with local spices. With the existence of Baron Techno Park, cluster 1 destinations have a modern look. With all those potentials, we argue that cluster 1 could be directed towards mass tourism. Figure 4 shows a glimpse of tourist destinations in cluster 1.

Different from cluster 1, cluster 2 mainly has two types of coasts. First is a type of volcanic coast that can be found on Siung and Wediombo beaches. In these areas, the morphological characteristics are composed of old Oligocene volcanic igneous rocks. Siung beach is famous as a camping ground and an exotic rock-climbing arena, which according to the professional climber it is coded blocks A to K, according to the level of difficulties. Many world-level cliff climbers have travelled and competed on this beach. In addition, in the eastern part of Siung Beach lies Pengilon hill, which is covered with wide green grass. From the top of this hill, tourists can look at other beaches in the vicinity, such as Wediombo Beach and Watu Lumbung Beach. It should be noted that the Siung beach is also known as a turtle habitat for laying eggs. In Wediombo beach, the cliffs and coast of this area portrayed the activity of the former Batur Volcano. [26] and [27] argue that this ancient volcano was composed of volcanic rock and igneous lava rock associated with breakthrough rock with andesitic composition, resulting in a natural mosaic of ancient lava deposition plate strokes interspersed with pseudokarst generation. As a result, the mound appears looks like Karst, but the inside core is volcanic rock.

The Jogan Tide Fall is another unique natural phenomenon that can be found in Cluster 2. This is a 12-meter-high waterfall on the beach that originates from two rivers. At high tide, the waterfall on Jogan Beach is submerged by seawater. On this beach, tourists can enjoy the beauty of the sea, however, it is quite difficult to go to the beach at the bottom of the cliff since it can only be reached by rappelling or canoeing from the other side of the beach. In addition, different from other beaches in the Gunungsewu tourists that have a wide area of sand, this beach has a narrow sand area. Figure 5 shows the beauty of Wediombo beach, Sadeng beach, and Jogan tide fall. The second is a type of the structurally-shaped coast that appears on the Ngungap and Sadeng Beaches. These beaches are characterized by steep cliffs, a straight coastline pattern, and an abrasion cave (sea cave) that is directly opposite the Indian ocean. Sadeng Beach which is located at the easternmost tip is the former estuary of the Bengawan Solo Purba which existed about 4 million years ago [28].

Figure 4: (a) Pilgrimage of Hindus people to the Segara Ukir Temple at the Ngobaran beach, (b) location of the Segara Ukir Temple at the Ngobaran beach that stands next to the mosque indicating a harmony community in the area, (c) a narrow bay on the Ngrenehan beach flanked by two cliffs, and (d) atmosphere on the Sanglen beach. Image sources: [23] [24] and [25]

Figure 5: The landscape beauty of beaches in cluster 2: Jogan, Wediombo and Sadeng. Source: Azisrif (2017)

As a result of the catastrophic event, the Australian plate plunged under Java Island during the middle Lower Pleistocene, approximately 1.47 million years ago, causing the lower mainland of Java Island to slowly lift almost 200 m, so that river currents cannot flow south to the Indian Ocean [29], but turned north towards the Java Sea as it is today.

Tourist destinations in Cluster 2 are typical of relatively isolated areas, with low population density, beaches in Cluster 2 on average have a narrow width, and steep terrain, so motorized vehicles must be parked far from the beach. However, cluster 2 is seen as having a more complete tourist attraction even though it tends to be stationary and even conventional. The available tourist attractions range from hiking, trekking, snorkeling, biking, birdwatching, rock climbing, caving adventures, geo-sites, geo-heritage, prehistoric life trail education, and conservation (turtles, rare plants, and earth evolution). The combination of the unique landscape is the gastronomic culture of the people who use recipes for processing inherited from generation to generation, often extreme and full of surprises such as fried grasshoppers, vegetables from banana tree trunks, and stir-fried cocoons (*entung* or *ungkrung*) teak caterpillars (*Hyblaea puera*) which are usually served together with red rice and green chili *lodèh* (a typical Javanese coconut milk vegetable dish). From the survey, it is known that fewer tourists come to cluster 2 but have a higher income than cluster 1. This is in line with the choice of more luxurious accommodation, more travel expenses, and enthusiasm for challenging types of tourism. Tourists who come are more concerned with seeking experiences than recreation. Based on the phenomena in Cluster 2, this area should be directed to the development of green tourism.

4.2. Green-tourism Plans for Coastal Development

The planning of green tourism to reduce travel footprint and minimize environmental degradation of the Gunungsewu Geopark (GG), especially in Cluster 2, is carried out based on three principles; (1) eco-friendly approach, (2) incorporate both ecological cultural aspects as a strategy to support the conservation of natural habitats along with the economic sustainability of local communities [30], and (3) align the economy and ecosystems to be economically viable. These principles may ensure that the planning could reduce poverty while preserving the environmental resources. Considering inputs and feedback during the Focus Group Discussions (FGDs), we ended with seven recommendations on how to develop coastal green tourism in GG. First, establish the governance and coordination of tourism actors in the village sector with the central and regional sectors to ensure a smooth transition to the green tourism industry. At this stage, a holistic and multi-level eco-tourism policy approach is needed with accurate information to ensure job opportunities and improve the local community's welfare.

Second, educate tourism actors to achieve sustainable tourism by reducing travel footprints, minimizing impacts, generating local economies, preserving the environment and culture, and providing knowledge, quality, as well as safety [31] and [32]. Knowledge of green tourism will influence behavioural intentions [33] and, subsequently, their intention to participate in mitigating environmental degradation [34]. It will strengthen the capacity of stakeholders, especially youth, to respond effectively to the global challenge of climate change in tourism destinations. Some of the recommended activities are using water and electricity responsibly, bringing cutlery, utilizing the e-ticket, sorting out garbage according to its type, and carrying reusable bags. The government could also assist in strengthening skills to produce environmentally friendly souvenirs or food packaging. Third, develop green tourism attractions related to trekking, hiking, biking, climbing, cave trekking, and eco-museums such as geo-site and geo-heritage conservation in the Mount Batur area and participating in the conservation of turtle habitat. This cluster could also develop lagoon destinations and unique attractions such as sunset views (Figure 6). Ethnoecological practices will produce an authentic cultural landscape by respecting local wisdom, increasing regional capacity, and gaining more attention from tourists [35]. Thus, scientific information about local knowledge, levels of biodiversity, and cultural landscape characteristics are critical [36], along with the support of local communities. These factors will guide the tourism industry toward a competitive and sustainable destination.

Fourth, design an environmentally friendly transportation system [37] using non-fossil fuel vehicles such as bicycles and electric vehicles. The aim is to balance the clean environment with the challenges of climate change and green supply logistics for sustainable tourism [38].

Fifth, synergize and adapt tourism infrastructure to the cultural landscape. The designation of the karst area should protect the terrain of soluble bedrock and the fragile environment surrounding it [39]. These efforts can be a stimulus for the growth of tourism activities that utilize the cultural landscape of GG. It is necessary to offer an attractive location and adequate services to develop green tourism. One of these services is an eco-lodge or eco-resort facility. It must be designed and built under traditional architecture and eco-friendly materials to reduce the negative impact on the environment [40]. The eco-lodge or eco-resort is a transportable and temporary building that does not require heavy equipment construction. It has many openings to access direct sunlight and wind. The insulation materials utilize eco-bricks and a green rooftop to reduce the temperature in the room [41] combined with geotextile to perform as a planting medium for vegetation [42].
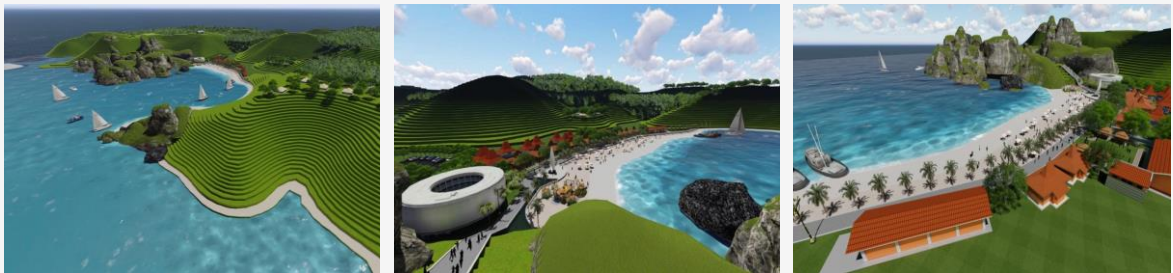

Figure 6: The proposed 3-D design of green tourism planning in the Cluster 2

Figure 7: The proposed 3-D design for open cafes area and pedestrian in Cluster 2

Another example is the open cafe area on the Indian Ocean coast. The primary material for the cafe is bamboo with a roof covered with local materials. The local materials have to be eco-friendly materials, for example, coconut leaves (*Cocos nucifera*), sugar cane leaves (*Saccharum officinarum*), rice stalks (*Oryza sativa*), alang-alang (*Imperata cylindrica*), or fibers (*Arenga pinnata*). The construction of a road corridor or footpaths for pedestrians uses eco-paving or eco-grass blocks. Eco-paving is a product consisting of sand and plastic mixture. Figure 7 shows the proposed design for open cafes area and pedestrians.

Sixth, initiate and assist local businesses and entrepreneurs in providing eco-friendly products, which the Global Ecolabelling Network recognizes its certification. It could also help local stakeholders build infrastructure and provide access to microfinance [43]. Besides protecting the environment and conserving endangered wildlife, the green tourism concept must also alleviate poverty by developing local socioeconomic to help local communities [44]. Local communities need to be encouraged to become active actors in eco-tourism, including providing lodging, being tour guides, selling traditional arts, and performing traditional dances. Typical traditional cultures from the South Coast of GG are *Ande-Ande Moss, Cokekan/Siteran, Gejog Lesung, Jathilan, Kerawitan, Mocopat, Reog, Thek-thek, Wayang Kulit* and *Gamelan* [19]. Tourists could also be given local gastronomy experiences [45] [46] by serving food using biodegradable packaging as a substitute for Styrofoam. In addition, the green tourism concept in the GG provides job opportunities for local communities to participate in tourist destinations.

Finally, accommodate tourists by providing an experience of living with native people, introducing cultural norms, respecting local tradition, and preventing commercialization of local culture [47]. Tourists could also explore local cultural values, including clothes, food, traditions, historical places, and traditional celebration. These cultural values will increase eco-tourism satisfaction from the tourists [40].

5. Conclusion

Gunungsewu Geopark (GG) is an exotic yet fragile world heritage karst area due to its geophysical conditions (i.e., soluble limestones). This area offers unique characteristics from the natural landscape and native cultural heritage, which based on the tourism attraction characteristics can be divided into 2 clusters. Cluster 1 is a group of beaches with coastal erosion due to intensive erosional and solutional processes in the karst topography, typical white sand, and mass tourism. This cluster includes Baron, Kukup, Sepanjang, Sanglen, Watu Kodok, Drini, Ngerumput, Krakal, Sadranan, Ngandong, Sundak, Pulang Sawal, Trenggole, Pok Tunggal, and Seruni beaches. Cluster 2 is a group of beaches that consist of volcanic coast and structurally shaped coast. The volcanic coast consists of residual morphology of Oligocene volcanic igneous rocks, while the structurally shaped coast is characterized by steep cliffs, a straight coastline pattern, and sea cave abrasion. This cluster includes Ngetun, Timang, Ngelambor, Siung, Watu Lumbung, Pesawen, Wediombo, Sedahan, Ngrungap, Srakung, Sadeng, Baronan, and Krokoh beaches. While Cluster 1 is mainly focused on public tourism, Cluster 2 focuses on natural landscape preservation.

Furthermore, this study concludes with several recommendations on how to develop coastal green tourism in GG. These recommendations are 1) establishing good governance and coordination between tourism actors, 2) educating stakeholders about green tourism and attraction development, 3) preserving (protection, use, and development) green tourism areas, 4) utilizing eco-friendly transportation systems, 5) synergizing and adapting green tourism infrastructure to prevent detrimental effects on landscape and culture, 6) initiating and assisting local businesses to produce green products, and finally 7) providing an experience of the local tradition to tourists.

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