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Bawean Geotrack: Linkage Between Geodiversity, Biodiversity, And Cultural Diversity for Driving The Acceleration Bawean Island-Gresik Geopark

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ABSTRACT

Bawean Island, Gresik Regency is geographically located in the Java Sea, precisely located between Borneo and Java. Currently, Bawean Island is being fought to become a Geological Heritage and continues to be developed, so that it can be proposed as a National Geopark. The Geology, Biology, and Cultural Diversity that exists on Bawean Island are still separate pieces that need further research so that it can be presented in a holistic order as geotourism. The purpose of this study is to examine geosite recommendations on Bawean Island and to reconstruct the geological history of the biological and cultural diversity of the community that developed from the past to the present in a Geosite Distribution Path Map (Geotrack). The methods used are literature review, observation of DEM imagery to determine morphology, and Geosite Potential Survey which is followed by feasibility study calculations based on parameters from the Geological Survey Center. The results of this study are in the form of a Geotrack Map consisting of 24 Geosites (15 Geodiversity, 3 Biodiversity, and 6 Cultural Diversity) which are contained in a digital system in the form of WebGIS so that all elements of society can access it. The occurrence of transgression and marine regression in the past caused by the formation of ancient volcanoes supports the formation of a typical flora and fauna ecosystem on Bawean Island. In addition, the formation of an island in the middle of the Java Sea surrounded by other cultures and civilizations led to the acculturation and cultural assimilation of the Bawean island.

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1. INTRODUCTION

Bawean is an island located 200 km north of Gresik Regency Bawean Island consists of two districts, namely Sangkapura District and Tambak District. Sangkapura sub-district consists of 17 villages and Tambak sub-district consists of 13 villages. The Bawean Island ring road is 57 km long. According to Hoogerwerf, Bawean Island was formed from the remains of an old volcano with a maximum height of 655 m which formed a volcanic cone (Azis. 1993). Volcanic material consists mainly of leucite and nepheline rocks. According to Setiadji (2006), Bawean Island is a product of volcanism from the subduction process of the Indo-Australian plate on the Eurasian plate which is quite unique because it is located in the Back-Arc magmatism section which has similarities with Mount Muria and Mount Lasem.

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According to the oral story of the Bawean people, there are 99 hills on Bawean Island. This story has religious overtones. The number 99 is associated with asmaul husna (the beautiful name of Allah). Natural beauty and cultural richness make Bawean plan to become a leading tourist attraction by the Gresik Regency Tourism Office (Usman. 2012).

Geoparks consist of a number of sites of geological diversity of special scientific importance, rarity, and beauty, known as geological heritage. Geoparks are not only related to geological diversity but also ecological values, and historical or cultural values. The importance of geological heritage is obtained from a variety of geological diversity that is distinctive, unique, and amazing, but cannot be renewed so it needs to be protected and conserved, and developed in a geopark container. Tourism is formed from the composition of geology, biology, and culture or commonly called geopark (Geological Agency, ESDM. 2017). As shown in Figure 1.

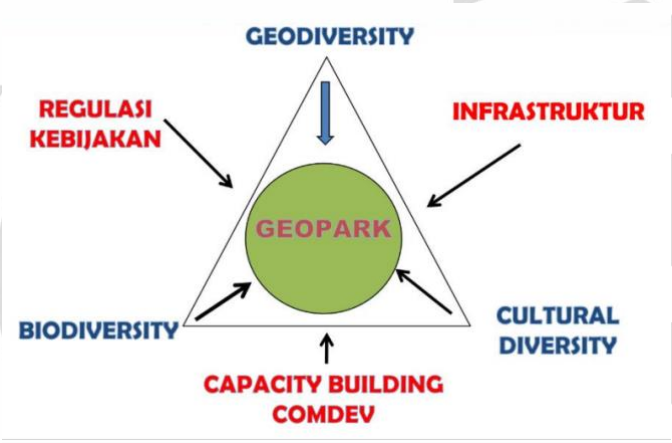


Figure 1 Main Pillar of Geopark Development (Geological Agency of ESDM. 2017)

Tourist sites on Bawean Island are still separate and stand-alone, making it difficult to understand the potential for geotourism development on Bawean Island. In addition, aspects of geodiversity, biodiversity, and cultural diversity are still not integrated with each other. Based on the description above, it is necessary to conduct research on the relationship between aspects of geodiversity, biodiversity, and cultural diversity on Bawean Island and try to make it unified and comprehensive in a recommended map of Geotrack paths so that tourists can more easily access all the beauty of Bawean and realize Bawean Island as a National Geological Heritage in the future.

2. METHODS

The data used in this study is in the form of secondary data from geological studies of previous research and Primary Data from the identification of geositc data carried out on tourism objects that have potential based on quantitative geositc assessment methods according to the Geological Survey Center (2017). Furthermore, the geositc information is included in WebGIS as a form of implementation to popularize geosites to the general public..

A. Primary Data Collection

As for what is carried out in collecting primary data on the scope of Bawean Island Gcopark Identification work which includes:

1) Geosite Potential Weighting

Geosite feasibility assessment based on geological agencies (2017) using 4 main parameters which include scientific value, educational value, tourism value, and degradation risk.

2) Spatial Data

Spatial data in the form of maps of the location of the research area, geosite location coordinates, and trajectories between geosites on Bawean Island arc taken from location survey data and then uploaded on the WebGis server online via the https://Bawcangeotract.gis.co.id page.

B. Secondary Data Collection

Secondary data collection activities include inventories of previous reports conducted by government agencies and others. These data arc in the form of literature studies related to tourism potential, geology, flora and fauna, and culture on Bawean Island.

C. Data Processing

Data processing is carried out in the form of preparing geological, biological, and cultural studies which arc then associated with the inventory and weighting of geosites on Bawean Island.

D. WebGIS Creation

WebGIS creation uses Location Based Service (LBS) methods. Location Based Service (LBS) is a location-based service that can display certain objects and display the position of their location. LBS can be accessed on mobile devices with internet media (Hcrmawan et al., 2017).

3. RESULT AND DISCUSSION

This section will discuss the geological aspects of Bawean Island, the results of geosite inventory and assessment, and the process of data input to WebGIS. The results of the geosite data inventory obtained as many as 25 Geosites consisting of 15 Gcodiversity, 3 Biodiversity, and 6 Cultural Diversity (as shown in Table 1. Scoring Geositc Bawean Island). The geological framework that is the basis for the relationship of geological, biological, and cultural stories discussed in this study arc Kastoba Lake Geosite, Tajungge'cn Geosite, Sawahmulya, and Kepuhlcgundi Hot Spring Geosite and Noko Gili Island

Geological Aspects of Bawean Island

Bawean Island is a volcano behind the Quaternary arc in the eastern part of Java Island which is included in the East Java Basin zone (Setijadji et al., 2006). According to Usman (2012), Bawean Island forms the Bawean Arc that extends from Mount Muria in a southwest-northcast direction. Bawean Island was formed as a result of volcanic activity in the Bawean Arc that separates the East Java Basin in the east and the Pati Basin in the west. Bawean Island has a relatively round island morphology with a diameter of about 12 km with a distribution of small islands around it.

According to Aziz et al. (1993), the formation of Mount Bawean began with Prc-Palcogcne tectonics. Magmatism activity in the Bawean Arc began with the formation of graben structures in Prc-Palcogcne bedrock which caused tears in the magma envelope to trigger magma to rise to the surface. Magma rises to the surface and forms a ridge that became the forerunner of the formation of the Bawean Arc.

Bawean Island is composed of several rock formations, including the oldest formation is the gelam lime-stone formation which in conditions in the field is generally as reef limestone such as in Kcpuhlcgundi Hot Springs and in Gelam Village. This formation is Late Oligoccne-Early Miocene or 28-16 million years ago. On top of this formation is found the Kepongan Sandstone Formation, which in a field condition is in Sungai Continue Village, Sangkapura District which is currently mined to be used as building materials. The age of this formation is estimated to be Late Miocene-Late Pliocene or about 11-3.6 million years ago. The formation that appeared later and was most dominantly found on the surface of Bawean Island was the Balibak Volcano Rock Formation (Azis. 1993). This formation is composed of material from volcanic eruptions, such as lava interludes, tephrite domes, volcanic breccia, and tuff which arc present in the field as rocks that make up the walls of waterfalls such as Murtalajer Waterfall, Kastoba Lake Waterfall, Laccar Waterfall. The youngest formation and still deposition today arc Alluvial Deposits whose deposition is relative to coastal areas (annexed to geological maps).

Bawean Island has 24 Geosites (15 Gcodiversity, 3 Biodiversity, and 6 Cultural Diversity) which are a whole and interconnected unit. Bawean Island is one of the back-arc volcanoes which is the result of basin modification. The movement of magma is associated with southeast-northeast fractures in bedrock. On the other hand, the formation of Bawean Island is closely related to the tectonic evolution of the Java Sea Paleogcncous which was controlled by three tectonic periods. The three tectonic periods are expansion and separation in the Paleogene to Early Miocene (Extensional Rifting Paleogene), pressure and rotation in the

Middle Miocene to Late Miocene (Compressional Wrenching Neogene), and the formation of ascending and folding faults in the Plio-Pleistocene (Compressional Thrust-Folding Plio-Pleistocene) (Usman, 2012) The uplift of Bawean Island's bedrock, namely limestone, is a result of the control of this structure. An ancient volcanic eruption in Bawean causes the existence of Kastoba Lake. Geothermal manifestations in the form of hot water in Sawahmulya and Kepuhteluk arc also associated with a volcanic activity that forms Kastoba Lake. In addition, Bawean Island which is in the middle of the Java Sea in the Sunda shelf causes the formation of endemic animals. The rise and fall of sea levels when volcanic islands arc formed causes the growth of coral reef ecosystems and becomes a place for spit formation in the form of Noko Gili Island.

Kastoba Lake

Kastoba Lake is located in the central part of Bawean Island in Balikterus Village, Sangkapura District. It is at an altitude and surrounded by hills. Kastoba Lake has the impression of being an isolated lake among hills. Kastoba Lake has an area of about 500 m x 500 m with a very lush surrounding state of trees. The shores of the lake have a relatively steep slope. There is already a small hall that is used as a place of worship and rest. In addition, there is also a toilet building that is not maintained (has collapsed) and is overgrown with wild plants.

Based on Hcndratno et al (2019), the dominant rocks scattered on Bawean Island have an aphanitic to porphyritic texture, all of which are associated with volcanic activity due to rapid cooling. The rocks can be attributed to eruptions around Kastoba Lake. The rocks that make up the Kastoba Lake area are gray-black volcanic breccia rocks with tapered fragments. Fragments arc pebble-sized. The composition of the fragments and the mass of the base arc equally dominated by volcanic material. The state of the rocks is quite weathered so at some points around the lake it is difficult to identify megascopic. Kastoba Lake is evidence of volcanic eruptions in the past, where this lake is a product of volcanic craters that are currently filled with water. Some sides of the Kastoba Lake wall leave narrow caves which are the result of the slope of the constituent layers of volcanic walls, mainly lava, and control of local geological structures, stout, and faults that create gaps in igneous rocks.

Biodiversity found in Kastoba Lake is the presence of endemic animals, Bawean Deer, and Wart Pigs. Bawean deer is a species of deer that currently only lives on Bawean Island in the middle of the Java Sea. The World Nature Conservation Institute (IUCN) has classified Bawean Deer as Endangered (Supardi. 2021). According to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), this deer is included in Appendix 1. That is, the number of wild Bawean deer is so small that it should not be traded. The warty pig or male wild boar (Sus verrucosus blouchi) was originally a subspecies of the Javan wild boar which are both endemic (Zahra et al, 2017). The Bawean Wild Boar is designated as a breed of its own. This decision puts the Bowei Wild Boar on par with the Bisaya Wild Boar and the Mini Pig, making it the rarest breed of pig in the world. In addition, there is little information about the existence of the Bawean Wild Boar.

The cultural diversity aspect of Kastoba Lake can be seen in the folklore and customs of the local community. Some of them are the mysterious gong sound from Kastoba Lake. Two mysterious gong sounds were found in Kastoba Lake which was kept hidden by the caretaker. The mysterious gong sound is a sign or sign of the start of the rice planting season and harvest season. The gesture is used as a culture by the surrounding community. There arc several caves around Kastoba Lake, which arc said to be still used for the hermitage of the Bawean people and outside Bawean. Asceticism was done to get closer to the universe and its God. Prohibition of bringing home anything from Kastoba Lake, either as small as a stone or as fragile as a twig. This has been proven by many people who do not believe in this. So local residents and caretakers prohibit tourists from bringing anything from Kastoba Lake. The thing that happens if the ban is done is heavy rain that does not stop until the items we take we no longer store in place, and some die. This prohibition gives the message that it would be more beautiful if we protect nature without disturbing or damaging it.

Hot Water Manifestations

Sawahmulya and Kcpuhlcgundi hot springs arc located in the middle of a lowland surrounded by hills. Based on Usman (2012), the presence of hot springs containing sulfur odor is an indication that there is a geothermal system that is working on Bawean Island. Water in aquifers is heated by magmatic systems or faults in the area, then rises through local fractures. The rocks exposed around the hot springs are limestone.

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In the hot spring of Sawahmulya, the exposed limestone has undergone contact metamorphism due to intrusion by lava into marble. While in the hot springs of Kepuhlcgundi, limestones found arc coral limestones and travertine deposits that are quite thick around the hot springs. The cultural diversity aspect found in these two geosites is the use of hot springs for local residents to bathe in sulfur hot springs to treat various skin diseases and help relax the body.

Tajungge'en

Location in Kumalasa Village, Sangkapura District. The morphology of this area is in the form of a beach facing southwest with a beach length of only about 25 m. In the north is a small hill that has a higher elevation that can be used as a place to see views of the Java Sea. This beach is formed by beach sand deposits derived from shell fragments and quartz sand. In addition, at this location carbonate rocks in the form of crystalline limestone arc exposed as cliffs around the coast which arc gelam limestone formations (Aziz, 1993). When viewed from the appearance of the air, it can be seen that limestone cliffs form a wall that surrounds the beach, so if the cliff is not maintained and eroded, it can occur that the beach will be lost because the waves of currents entering the beach will be stronger and erode the shoreline. In this location, garbage is well found, only a little garbage is left here.

Noko Gili Island

The existence of volcanic activity that formed Bawean Island also caused the formation of small volcanic islands (Aziz. 1993). Location in Sidobangunanbatu Village, Sangkapura District. The morphology of this area is in the form of two islands in the eastern part of Bawean Island (The main island or large island is called Gili Island and the second island is called Noko Island or a small island). Noko Island is a small island in the middle of the sea with a beautiful stretch of white sand that stretches about 600 m by 25 m wide. The rocks found on Gili Island arc igneous rocks, basalt lava, lapilli tuff, and also pyroclastic breccia which is thought to have once had volcanic activity on this island. The uplift of Bawean Volcanic Island caused the formation of coral reef ecosystems around Bawean Island.

Noko Island is a separate island formed from the accumulation of quartz sand deposits and coral reef fragments carried by currents from both sides of the island which over time will thicken and form a plain (island). In the shallow sea around the island can be found coral reefs that grow well because of the clear water. The cleanliness and clarity of this water need to be maintained because if the coral reefs around the island die or do not grow well, then the supply of sediment fragments carried by the current will decrease, so that the sediment on Noko Island will thin out and over time it can sink At this location the garbage is very bad, especially on Noko Island. Garbage is scattered very much around this. This garbage also not only comes from this island but also comes from outside which enters due to the waves deposited on the coast of Noko Island.

There are residents on this island because around this island there arc floating net cages for grouper rearing and there are also fishing villages. This island has a fairly wide area of coral reefs, but only a few whose coral reef conditions are still in very good condition. In the western part of the island, most of the coral reefs have suffered a lot of damage due to reef fishing activities carried out using bombs and Potassium Cyanide. The type of coral reef ecosystem on Gili Island is fringing reef with flat coral reef conditions or reef flat that is quite extensive (Handoko. 2008).

The biodiversity aspect of this geosite is the diversity of coral reefs that grow around the island of Gili Noko (Handoko. 2008). In Handoko (2008), coral reefs on Gili Island arc included in the category of Fringing Reefs based on Darwin's classification (1984). This causes a lot of fish diversity in the waters around Bawean Island.

WebGIS Geotrack Bawean Island

WebGIS Bawean geotrack is created through the https://gis.co.id page (. GIS) which is made by Circlegeo. Admin actors have access to login, process data about webGIS, process data and information, process news, and process comments on webGIS. While the user actor can access webGIS, access data, and access or write comments. The advantage of creating webGIS using GIS is that it can be done without coding.

Registration is done using email then register to apply for the WEB GIS domain name. After success, the admin actor can create a webGIS as per the admin destination. At. GIS data will be stored in cloud storage with an initial storage capacity of 50 MB. This data capacity will decrease as the data is uploaded. Data types that can be uploaded arc formats commonly used in spatial data such as shapefiles, rasters, geojson, and spreadsheets. Before the data upload process, inventory location data and geositc references are first

combined in one ZIP file containing geositc coordinate point shapefiles, tracking trajectories, Bawean Island areas, explanations, and documentation of each geosite. The file is then uploaded to the website and immediately accessible to the public. The final result of the Bawean WebGIS geotrack can be accessed through an internet browser by visiting the https://Bawcangeotract.gis.co.id page

Penilaian Geosite

The results of the geosite assessment can be categorized according to the feasibility level based on the table in Appendix 3. The assessment can be grouped by category according to the value interval from 0 (lowest value) to 16 (highest value). When referring to the feasibility level category based on Table in Appendix 3, the location of the geositc at the research location can be grouped based on the feasibility level which can be seen in Appendix Table 3. The results of the geosite feasibility assessment on Bawean Island show a good feasibility level for all geosites because it has a feasibility value from 9.1 to 11.75.

Plan Recommendation

Improvement of expertise (tour guide) through a knowledge transfer program from geologists and gcotourism experts to local people.

From the port of Gresik on the island of Java, tourists can take a boat for 4 hours to arrive at the port of Bawean. Geosite recommendations must be visited to represent the geological framework of Bawean Island with a relatively short estimated time (3 days), including the estimated first day: Sawahmulya and Tajhunggc'en hot springs. The estimated second day of captive deer, Kastoba Waterfall, and Kastoba Lake. Estimated third day: Noko Gili.

Estimated time needed if all geosites arc to be visited, namely: 7 days, including the estimated first day (as the day of arrival) laccar waterfall, Sawahmulya hot spring, and jherat lanjhcng. Estimated day two of the deer captivity, tajhungge'en beach, and ria beach. Estimated day three is China Island, Jhembhcngan Beach, Mortalajer, and Walia Zainab's Tomb. Estimated day four Kastoba Waterfall, Kastoba Lake, and Cellong Beach. Estimated day five Teletubbies Hill, Mayangkara Beach, Kcpuhlagundi hot water, Kcrrong Beach, and mangroves. Estimated day six noko gili, noko selayar and selayar beach. Estimated seventh (last) day tomb of Purboncgoro and Maulana Umar Mas'ud Tomb.

4. CONCLUSION

Bawean Island is an area that has great potential to be used as a geotourism place. Geosite potential that is revealed has a very interesting beauty, and history, and local wisdom, which must be maintained and considered in the process of developing existing tourism potential.

The results of the analysis conducted show that the development of Geotourism objects in the Bawean Island Area has not been optimal in several aspects such as geosite accessibility for tourists. Therefore, through the concept of integration and several physical and non-physical development plans, it is hoped that tourism objects in the Bawean Island Area will develop more in the future and support sustainable development.

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