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How Eco-Spatial Edutourism Support Sustainability in Coastal Areas in South Malang, Indonesia?

Como o Eduturismo Ecoespacial Apoia a Sustentabilidade em Áreas Costeiras no Sul de Malang, Indonésia?

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Abstract

This study aimed to determine the effect of edutourism based on eco-spatial to support sustainability in coastal areas in South Malang, East Java, Indonesia. The qualitative research design is conducted at Kondang Merak Beach, Pesanggrahan Beach, Bajulmati Beach, CMC (Clungup Mangrove Conservation) Tiga Warna, Tamban Beach, and Perawan Beach, which located in South Malang Regency, East Java, Indonesia. Data were taken using participant observation, documentation, and in-depth interviews. Data analysis used qualitative analysis from Miles and Huberman, consisting of three stages, reduction, data presentation, and conclusions. The result found that each beach has unique qualities depending on the surrounding environment and can be developed into an edutourism destination. Edutourism has benefited environmental sustainability, showed in the condition of natural resources in maintained tourist attractions (mangroves, coral reefs, pine shrimp, sea pandanus, turtles, and crabs), and maintained cleanliness at tourist areas.

Keywords: Tourism; Marine Conservation; Environmental

Resumo

Este estudo teve como objetivo determinar o efeito do eduturismo baseado no ecoespacial para apoiar a sustentabilidade em áreas costeiras no sul de Malang, East Java, Indonésia. O projeto de pesquisa qualitativa é conduzido em Kondang Merak Beach, Pesanggrahan Beach, Bajulmati Beach, CMC (Clungup Mangrove Conservation) Tiga Warna, Tamban Beach e Perawan Beach, localizadas em South Malang Regency, East Java, Indonésia. Os dados foram coletados por meio de observação participante, documentação e entrevistas em profundidade. A análise dos dados utilizou a análise qualitativa de Miles e Huberman, composta por três etapas, redução, apresentação dos dados e conclusões. O resultado constatou que cada praia possui qualidades únicas dependendo do ambiente circundante e pode ser desenvolvida como um destino de eduturismo. O eduturismo beneficiou a sustentabilidade ambiental, mostrou-se na condição de recursos naturais em atrações turísticas mantidas (manguezais, recifes de corais, camarões pinheiros, pandanus marinhos, tartarugas e caranguejos) e manteve a limpeza nas áreas turísticas.

Palavras-chave: Turismo; Conservação Marinha; Ambiental

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1 Introduction

Southern Malang Regency is composed of various hills and coastal areas, extending from the Javanese Southern Mountains to the Blambangan area on the eastern point of East Java (Labib et al. 2020; Suprianto et al. 2017) The area of Malang Regency is about 2,977.05 km^2, and sea waters are 632 km^2. In addition, there are 20 small islands in Malang Regency with a coastline length of 85.92 km (RTRW Kabupaten Malang 2018). The findings of the overlapping process in the GIS analysis suggested that the Wetan and Bantur districts are the most prospective ecotourism areas since coral reef ecosystems, seaside beds, mangroves, and reef fish are present. The list of beaches in Sumbermanjing Wetan and Bantur sub-districts are Perawan Beach, Tamban, Sendangbiru, Kondang Buntung, Gatra, Tiga Warna, Clungup, Goa Cina, Watuleter, Pesanggrahan, and Balekambang and Kondang Merak. The subdistrict is included in the suitability requirements, which are relatively strict (S1), as it covers an area of 196.13 km^2 or 32.98% of the entire research area (Puspitasari 2015).

This research was conducted at Kondang Merak Beach, Pesanggrahan Beach, Bajulmati Beach, CMC Tiga Warna, Tamban Beach, and Perawan Beach as edutourism destinations, which located in South Malang Regency, East Java, Indonesia. The location was chosen based on the findings of Puspitasari (2015) stated that the place was ideal for edutourism, and the findings of field observations indicating that these areas were suitable for edutourism-based tourism. Edutourism is a learning activity with tourism to increase knowledge and understanding for tourists both formally and informally. According to Bodger (1998), edutourism is tourism education with group travel visiting tourist destinations to participate in learning experiences directly relevant to the location. Wang and Li (2008) stated that edutourism activities are educational tours related to technology tourism and environmental protection tourism.

Several studies have reported the importance of edutourism in the tourism industry. Edutourism provides sustainability from various aspects of life (Sumarmi et al. 2022). Integrating education into tourism will ensure environmental sustainability (Ioppolo et al. 2013; Slocum et al. 2019). Additionally, the education industry contributes to environmental sustainability by completely integrating the curriculum (Benckendorff et al. 2012; Mínguez et al. 2021; Slocum et al. 2019). Moreover, there are benefits to economic, social, and cultural sustainability (Jamal et al. 2011; Mínguez et al. 2021). Therefore, edutourism will be the main factor of tourism development in the future.

Eco-spatial edutourism is a tourist concept which integrates educational and spatial locations that are balanced with nature. Within this particular context, the term "education" relates to an alternative of tourism that connects individuals with educational aspects covering culture, history, science, or the natural environment. The term "eco-spatial" refers to the environmental and spatial dimensions that are responsible for the balance between human actions and their impact on the environment (Pulido-Fernández et al. 2019). The previous statement indicates that the concept of "eco-spatial education" encompasses the fusion of educational elements and ecological sustainability, while maintaining a harmonious and sustainable spatial arrangement. This idea enables tourists to engage in educational pursuits that involve tourist destinations that connect with natural elements, while also being aware of the ecological impact of human activities (Ioppolo et al. 2013; Slocum et al. 2019). In edutourism, the eco-spatial structure must establish a harmonious connection between space (people, tourist sites, sociocultural contexts) and the environment (Guo et al. 2007). Furthermore, it is essential that the spatial configuration takes into account the integration of individuals, tourist destinations, and socio-cultural contexts with the surrounding environment, and creates areas that facilitate respectful interactions among them. By adopting this approach, visitors will establish a sense of attachment to the indigenous surroundings and traditions, while simultaneously experiencing a sense of ease and security in that environment. Therefore, this study aimed to determine the effect of eco-spatial edutourism to support environmental sustainability in the coastal area of South Malang.

2 Methodology and Data

The research design is qualitative research to understand the phenomenon of behavior, perception, motivation, action, and so on by description in words and language, in a specific natural environment, and various natural methods (Moleong 2021). This research was conducted at Kondang Merak Beach, Pesanggrahan Beach, Bajulmati Beach, CMC Tiga Warna, Tamban Beach, and Perawan Beach as edutourism destinations, which located in South Malang Regency, East Java, Indonesia. The research location is shown in Figure. 1.

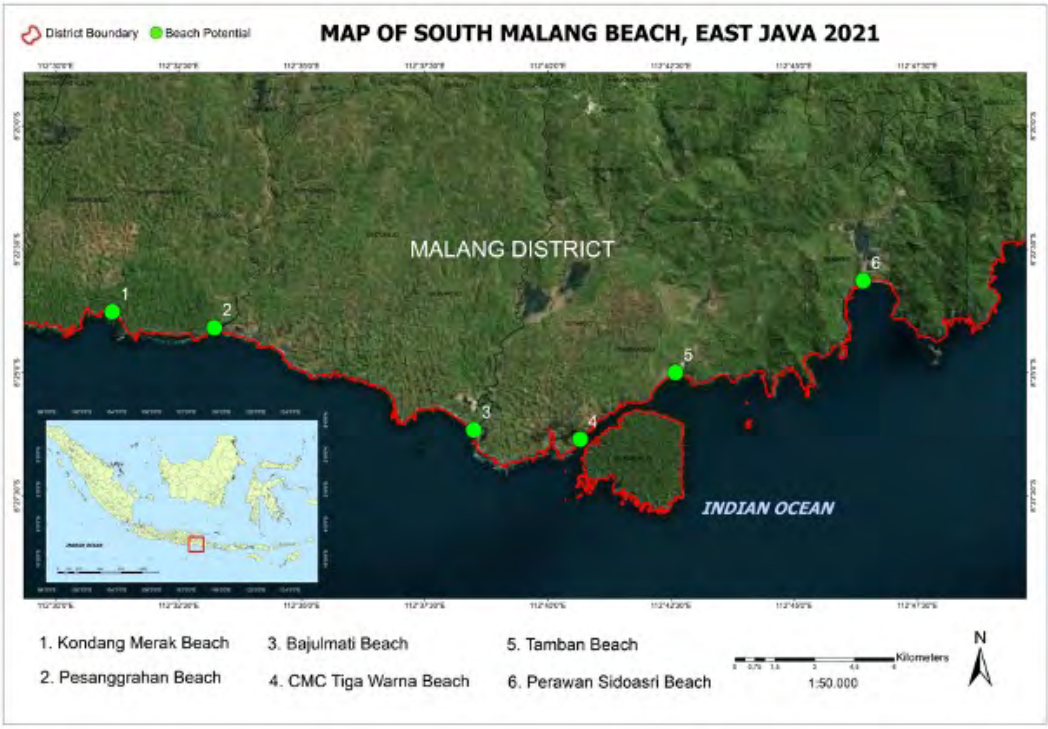

Figure 1 South malang beach as edutourism destination has 6 spots along the coast (green dots) with each beach had different characteristic.

The South Malang Regency includes a diverse topography, comprising of both hilly terrain and coastal areas, covering from the Southern Mountains of Java to the Blambangan area situated at the eastern tip of East Java (Labib et al. 2020; Suprianto et al. 2017). The total land area of Malang Regency is approximately 2,977.05 km², with an additional 632 km² covered by sea waters. Furthermore, Malang Regency covers a total of 20 small islands, which boast a combined coastline measuring 85.92 km (RTRW Kabupaten Malang 2018).

The results of the GIS analysis reveal that Wetan and Bantur Regencies exhibit a high potential for ecotourism due to the presence of diverse ecosystems such as coral reefs, seabed, mangroves, and coral fish. The Sumbermanjing Wetan and Bantur sub-districts are home to a variety of beaches, including Virgin Beach, Tamban, Sendang Biru, Kondang Buntung, Gatra, Tiga Warna, Clungup, Goa China, Watuleter, Pesanggrahan, as well as Balekambang and Kondang Merak. The district is included in the relatively strict suitability requirements (S1), because it has an area of 196.13 km² or 32.98% of the entire research area (Puspitasari 2015).

Data were taken using participant observation, documentation, and in-depth interviews. Key informants were determined using a purposive sampling technique with the snowball throwing method (Sugiyono 2010). The snowball technique is a research methodology that involves identifying initial sources through a variety of references, including previous articles, online resources, books, and direct input from knowledgeable acquaintances or experts in the field of study. Then, utilize these sources to locate additional data related to the identical subject matter. The scope of the obtained information must be restricted based on the topic under consideration, followed by a thorough evaluation of its precision and dependability.

Data analysis used qualitative analysis from Huberman and Miles (1992), consisting of three stages: reduction, data presentation, and conclusions. The stages of data analysis are as follows: (1) recording all phenomena found in the field either through observation, documentation, and interviews; (2) reviewing notes from observations, interviews, and documentation studies, as well as separating data that are considered important and unimportant according to the research focus; (3) describing classified data in terms of the research's focus and objectives; and (4) concluding final analysis. These activities are carried out continually and continuously, from start to finish in the field. It is done to ensure that every verification or findings drawn are consistent with the study focus that has been selected while validating the data through triangulation and Focus Group Discussions (FGD).

3 Results and Discussion

3.1 Eco-Spatial Edutourism in South Malang Beach

Kondang Merak Beach

Kondang Merak Beach focused on coral reef conservation tourism and fauna and flora biodiversity. Visitors have the opportunity to learn about the process of of coral reef restoration, including techniques for the cultivation and construction of coral reef structures. The data analysis showed that the Kondang Merak Beach area is currently very concerned about conserving protected forests that are well maintained. This forest covers six villages in two sub-districts and is the best coastal protected forest in the Java region besides nature and cultural resources. Visitors engage in observing and conducting research on the flora and fauna, as well as the interactions between organisms and human activities, that occur within protected forest ecosystems. Furthermore, visitors have the opportunity to study about the geomorphological explosions in karst areas by observing and analyzing the karst rock types, geological structures, and the hydrochemical features of underground water systems. Further, several extinct endemic faunas were found in the Kondang Merak area, such as leopards, Javanese langurs, and Javanese eagles (interview with Mr. A, key informant & volunteer). In addition, there are also 130 species of birds and 150 species of butterflies which account for 56 percent in Malang Raya and 20 percent in Java Island, 4 types of dolphins, 4 species of turtles, several whales, and other animals that have not been explored. The protection of wildlife and vegetation remains a major challenge for the local community and volunteers to maintain its sustainability. The significance of environmental sustainability is closely associated with the role of local communities and volunteers to maintain it (Gooch & Warburton 2009).

Moreover, other activists live in or serve as facilitators in local communities, providing education, socialization, and direct assistance. Besides Mr. A, who serves as a volunteer and facilitator, a tour guide is helped by Mr. B, a long-time resident of the Kondang Merak ecotourism area. Mr. A and Mr. B are community members who play an important role in developing marine ecotourism and empowering fishermen in Kondang Merak. They both are local environmental leaders who have changed the environment in the town (Mino & Hanaki 2013).

Edutourism in Kondang Merak Beach is more focused on coral reef conservation. The observation results showed that fishermen, conservation groups (Sahabat Alam Indonesia), and the Malang Maritime and Fisheries Service Branch had planted fish apartments. This activity is carried out to provide a home for organisms, mainly fish, by providing new habitats for the attachment of organisms that contribute to the food chain and by providing new habitats and increasing the complexity of basic habitats in which function as components of the coral reef's physical environment (Ahmad 2017; Rendle & Rodwell 2014; Wu et al. 2016). The research results from Kamaali et al. (2016) at Bangsring Beach Banyuwangi found that planting fish apartments can restore fish resources and increase catches up to 100% on the close fishing distances, efficient in catching time and restore damaged aquatic ecosystems in Bangsring waters, Banyuwangi, East Java.

Visitors have the opportunity to learn about coral reefs and engage in the process of coral transplantation. Visitors to the Kondang Merak beach indirectly help to reduce climate change. Visitors engagement in the restoration of damaged and endangered coral reefs presents an opportunity for understanding the significance of preserving the balance of marine ecosystems, reducing destruction, and gaining special and valuable experiences in coral reef conservation activities (Sumarmi et al., 2022). It will create a meaningful experience for tourists (Larsen 2007; Mason & O'Mahony 2007). This experience will have a good impact on the sustainability of edutourism in coastal tourism objects.

Moreover, the area near the fishing village offers culinary tourism by presenting the seafood potential of Kondang Merak. The processing of marine catches can enhance their market value, as opposed to their immediate sale in their unprocessed form. The utilization of existing local potential in fishing communities certainly enhances their economic prospects (Bare et al. 2020; Potts 2010). The view of Kondang Merak Beach is shown in Figure 2.

Figure 2 The view of Kondang Merak Beach: A. A tropical forest background; B. Small Islands in front.

Pesangggrahan Beach

Pesanggrahan Beach is a learning center for students from elementary to university as well as the general public. Visitors are introduced to and observe the flora (Verbenaceae, Tectona Grandis, Malus Sylvestris Mill, Tabernaemontana Sphaerocarpa BI, Ficus Benjamina L), fauna (Bucerotidae, Greater Green Leafbird, and Nycticebus javanicus), habitats, and interactions of forest ecosystem components. Ecological studies of animal populations and communities such as bird watching, langur observations, nocturnal animals, analysis of animal tracks, insect ecology, marine biota ecology, plant ecology, flora nurseries and care for animal rescue, landscapes nature, geohydrology, and others.

Pesanggrahan Beach is located in the Protected Forest Area in the eastern part of South Malang. Administratively, this area is located in the village of Srigonco, Bantur District, Malang Regency, 66.3 km from Malang City, for approximately 2 hours travel time. Astronomically, the Protected Forest Area of Pesanggrahan is located at 8°23'34" LS - 8°24' 15 "LS and 112°32'58" East Longitude-112°33'42 "E with a total area of 95 Ha. This area consists of two types of forest, namely 45.61 ha of protected forest and 49.68 ha of production forest. Pesanggrahan Beach is geographically bordered by the Indian Ocean in the south, the Southern Cross Road in the north, the Berek River in the east, and the Protected Forest in the west.

The protected forest is an area of the home (habitat) for biota diversity. The protected forest in the Pesanggrahan area is located on a 97G plot with a Protected Forest (Hutan Lindung) class, covering an area of 106.10 ha. The plants often found are Sapen, Gondang, Ipik, Ringin, Munung, Timoho, and others that grow well. However, some of the protected forest bordering in Pesanggrahan Beach has been currently turned into agricultural land. The changes that will occur may result in unstable ecosystem conditions (Barbour 1980; Mueller et al. 1974). Several protected forest areas in the South Malang area have been opened and developed into tourist destinations. In addition, the construction of the Southern Cross Road (Jalur Lintas Selatan) has divided the Southern Malang Protected Forest Area. It will accelerate the degradation of protected forest ecosystem services and result in a loss of biodiversity in the South Malang area.

Furthermore, Pesanggrahan Beach is a natural laboratory for estuary study in tourist areas. Pesanggarah Beach, which is a meeting spot for fresh water from rivers and streams, contains a mixture of saltwater from the sea. This condition is extremely appealing to visitors with specialized interests in bathymetry, shape, size, depth, water circulation patterns, sedimentation, and erosion. Moreover, visitors are invited to participate in the testing of water temperature, salinity, acidity, nutrient concentrations, and dissolved oxygen levels. The view of Pesanggrahan Beach is shown in Figure 3.

Therefore, the concept of edutourism that could be implemented at Pesanggrahan Beach is associated with the protecting of sand mines and the management of forests based on community involvement, as determined from the conducted data analysis. The objective of protecting sand mines at the next phase is to preserve river systems and mitigate the degradation of coastal ecosystems (McLachlan et al. 2013). The objective of community-based forest management is to maintain the sustainability of the forest area that surround Pesanggrerahan Beach. This is in accordance with the motto of the Ministry of Forestry "sustainable forest, prosperous society". The success of forest resource management so far has been impacted by the process in which the government and associated organizations (including but not limited to the community, academic institutions, and non-governmental organizations) have executed forest management practices (Lindstad 2016; Mohammed et al. 2017).

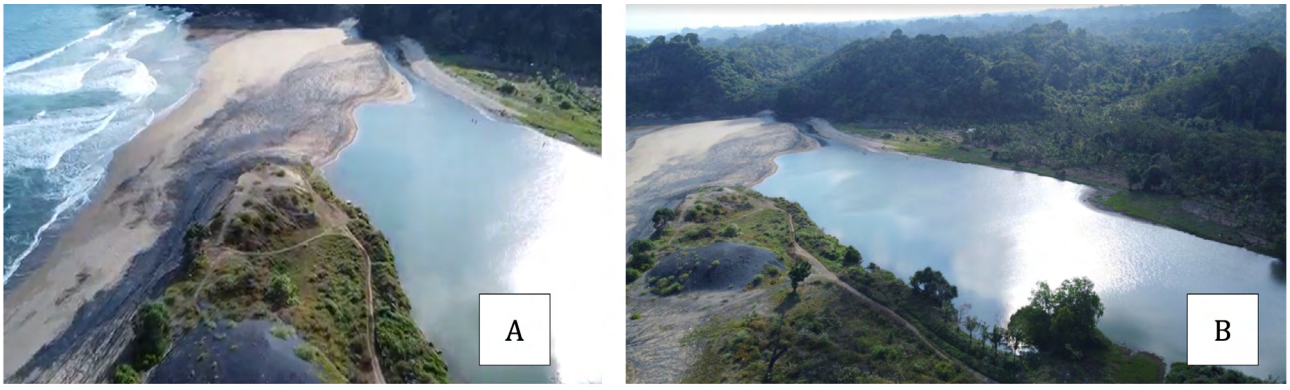

Figure 3 The view of Pesanggrahan beach: A. Sand Deposits near the Berek River at Pesanggrahan beach; B. Protected forests in the border of production forests.

Bajulmati Beach

The data study showed that Bajulmati Beach, as an edutourism destination, promotes turtle conservation (shown in Figure 4). The turtle conservation began with a non-governmental group called "Pilar Harapan", founded in 2014. This was initiated by growing awareness of turtle protection on East Java's southern coast, particularly at Bajulmati Beach (Purnama et al. 2020). Corporate Social Responsibility (CSR) by Fuel Company (PERTAMINA) in Malang has built and inaugurated the BSTC (Bajulmati Sea Turtle Conservation) Turtle House in 2018. BSTC is a home for turtle eggs obtained from along the coast of Bajulmati Beach, including Green Turtles, Leatherback Turtles, and Lekang Turtles. The Lekang or Gray turtle is an endemic turtle in the area (Pertamina 2020). After the eggs hatch, the hatchlings are released back into their natural habitat. This activity usually involves universities, government agencies, and tourists. The egg hatching activities is shown in Figure 5A-D.

The BSTC Turtle House has a hatchery for eggs and a hatchling turtle pool and hall, outdoor waiting area, and nature school. These buildings are integrated to support education for tourists visiting Bajulmati Beach. The waiting room with an outdoor view was intentionally made for tourists before entering the turtle egg breeding area or hatchling pond, also functioned as a learning or ceremonies place. Mr. S as the Chair of the BSTC usually provided briefing and initial knowledge to tourists about turtle houses and turtle conservation. This activity is carried out before

Figure 4 The view of Bajulmati Beach.

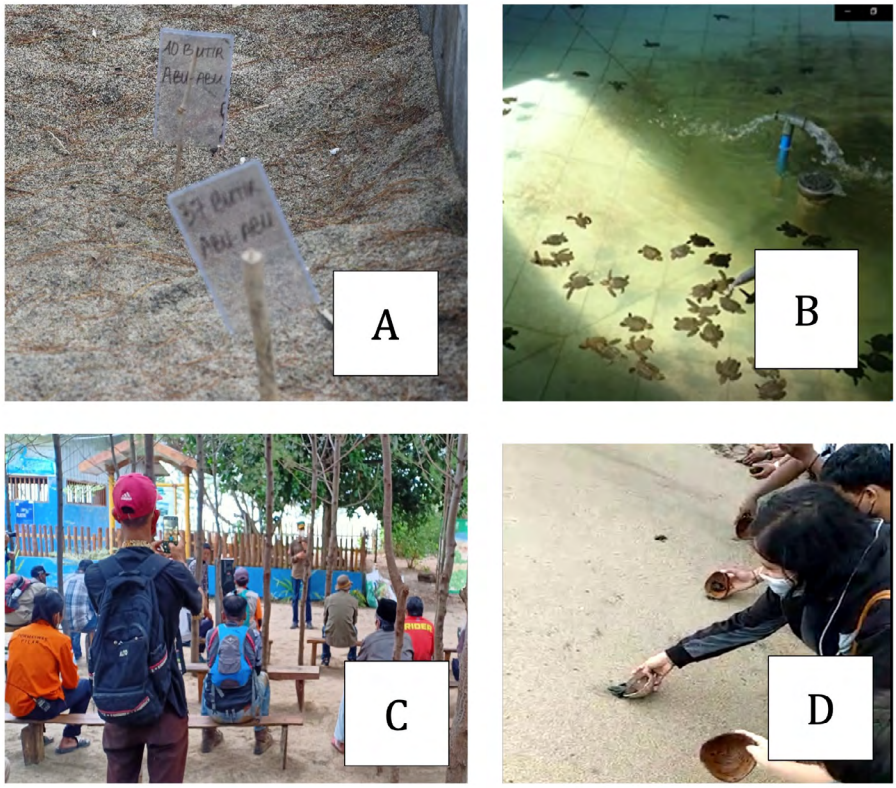

Figure 5 A. Turtle egg hatchery; B. Turtle hatchery area; C. Turtle releasing ceremony; D. Releasing turtles to the beach.

tourists enter or participate in releasing hatchlings into their natural habitat. Meanwhile, the nature school is made for the local community to learn directly from nature. Natural schools are opened on Mondays and Thursdays twice a week, starting from 14.00-16.00 WIB, because students attend formal schools in the morning.

This activity provided direct knowledge and experience to tourists about Bajulmati Beach's ecosystems, such as turtle conservation and the types and functions/ benefits of sea pandanus, sea pine, and mangrove forests in conservation areas. Practice activities are often carried out, such as making woven from leaves and making oil from sea pandan leaves.

In addition, local wisdom must also be preserved. Applying an ecotourism strategy to environmental sustainability is necessary without eliminating local wisdom and the community's economy in coastal tourism areas (Sumarmi et al. 2021). This activity will bring environmental sustainability to Bajulmati Beach and the local community's economic, social and cultural sustainability (Jamal et al. 2011; Mínguez et al. 2021). Tourist visits also have a meaningful experience that makes it possible to return with new knowledge of conservation awareness (Larsen 2007; Mason & O'Mahony 2007). The view of reservoir in Bajulmati Beach is shown in Figure 6.

CMC Tiga Warna Beach

Clungup Mangrove Conservation (CMC) Tiga Warna is located in Sendangbiru village and is managed by the Bhakti Alam Foundation. This conservation area included Tiga Warna Beach (see Figure 7A), Gatra Beach (see Figure 7B), and Clungup Beach (see Figure 7C). CMC is one of the largest and most developed ecotourism on the coast of South Malang. CMC Sendangbiru focused on conservation activities by limiting the number of tourist visits and hours/duration of tourist visits and checking visitors' luggage. It is created to regulate the number of tourist visits to maintain the environment's carrying capacity to keep comfort (Kusumastuti & Pamungkas 2018). The baggage checklist is also strictly required. The luggage checklist is used at entry and exit to ensure that no waste is left behind. Penalties are given for visitors to break the rules.

Each beach in the CMC Sendangbiru area offered specific beauty and uniqueness. The main attraction in Tiga Warna Beach area are snorkeling and coral reefs; Gatra Beach was known for the beautiful long beach; and Clungup Beach focused on mangrove conservation and processing plastic waste. Tourists must always be accompanied by a local guide to accompany tourists and provide education about the natural potential. The management also provides

Figure 6 Reservoir for fresh fish.

Figure 7 Clungup mangrove conservation is located in Tiga Warna beach near to Grata Beach: A. Clungup Mangrove conservation; B. Gatra beach; C. Students planting mangroves in the conservation areas.

a group learning package in which visitors can participate actively in conservation, such as planting mangrove seedlings, including training on mangrove types and their roles, and teaching crab culture in the mangrove forests. It provided tourists with a new and significant experience, allowing them to leave with a positive image and memory, making it possible to return in the future (Prayag 2009; Tsai 2016). In addition, tourists can also transplant coral reefs at Tiga Warna Beach.

Tourists' experiences in the CMC Tiga Warna Sendangbiru area are certainly better and more engaging than other beach attractions on the southern coast of Malang. It is due to edutourism offered has developed well and has a variety of choices. New tourist experiences and understanding can be a strong predictor of tourist intentions and affect the impression and destination of tourist objects (Rasoolimanesh et al. 2021; Tsai 2016; Tung & Ritchie 2011). In addition, there is also a gazebo called "Pasinaoan Noto Urip Board" in the CMC area. This gazebo can be used for discussion areas between tourists and local guides or management. Tourists with new experience and knowledge might provide comments or ideas on the activities, particularly conservation activities. Tourist participation in planning also gives a positive experience and impression for tourists (Bigne et al. 2020).

Tamban Beach

Tamban Beach is located in Tambakrejo Village, Sumbermanjing Wetan District, Malang Regency. Tamban Beach offers mangrove conservation as edutourism destination. The data analysis showed that Tamban Beach participated in developing edutourism after Kondang Merak

Beach and CMC Tiga Warna Beach. Mangroves at Tamban Beach are managed by Karang Taruna (youth organizations) of Tambakrejo Village to be developed as educational tourism. The youth organization has collaborated with POKMASWAS (Monitoring Community Group) in the area starting in 2017. The conservation area is still undergoing renovation, with inadequate utilization, managed by youth organizations. There are 59 members of the youth organization involved in mangrove conservation, while the POKMASWAS members are around 30 people. The youth organization then formed a legal organization named Gunung Piting Mangrove Conservation (GPMC). The activities of GPMC members are carried out once a week, such as community service on Fridays. The view of Tamban Beach is shown in Figure 8.

Tamban Beach offered Edutourism in managing 15 hectares of mangrove forest with good conditions (Harahab & Setiawan 2017). However, it is still active in expanding and planting mangrove seedlings. GPMC has received the assistance of 45000 mangrove seedlings from the Ministry of Environment and Forestry. Visitors can take a walk across the bridge while enjoying views of the natural forest and the beach from the railing that separates the mangrove forest. Certain locations are furnished with designated areas for tourists to take selfies.

Besides, a jogging track is also provided for tourists to explore the mangrove forest on Tamban Beach. Furthermore, a jogging track is available for visitors to travel through the mangrove forest located on Tamban Beach. The availability of a jogging track facility offers tourists an interesting and advantageous experience, allowing them the chance to engage with the natural environment while enjoying physical activity. Tourists can also participate in the nursery and planting of mangrove trees. The manager has created a plantation for guests interested in participating in the reforestation of Tamban Beach's mangrove forest. Tourists can participate in planting mangrove seedlings directly in the area provided by the manager. GPMC managers have been making souvenirs at Tamban Beach by processing mangrove seeds into mangrove coffee.

Visitors to Tamban Beach will gain new experiences and knowledge, especially about mangrove conservation, such as selecting mangrove seeds from mangrove seeds then prepared areas for planing the seeds. Tourists were also given information about the types of mangroves and the benefits of mangrove trees for life. Moreover, a local guide is also responsible for explaining the mangrove ecology that exists. This activity provided benefits for tourist attractions. The benefits obtained by tourism objects are environmental and economic sustainability (Jamal et al. 2011; Mínguez et al. 2021). Meanwhile, tourists' new experiences and knowledge benefit both tourists and the sustainability of local tourism destinations (Bigne et al. 2020; Rasoolimanesh et al. 2021).

Furthermore, the manager of GPMC provides a riverside tour of the mangrove conservation area, which is intended to offer visiting tourists an opportunity to appreciate the natural beauty and understand the importance of maintaining river sustainability. This activity is one of the tour packages that can be offered as a tourist attraction, and it is expected that visitors will gain knowledge about the sustainability of tourist destinations through their experience (Bigne et al. 2020; Rasoolimanesh et al. 2021).

Perawan Beach

Perawan Beach, or Sidoasri Beach, has a stunning view because the basin appears to be flanked by two bays. This beach has white and tends to brown sands. The green

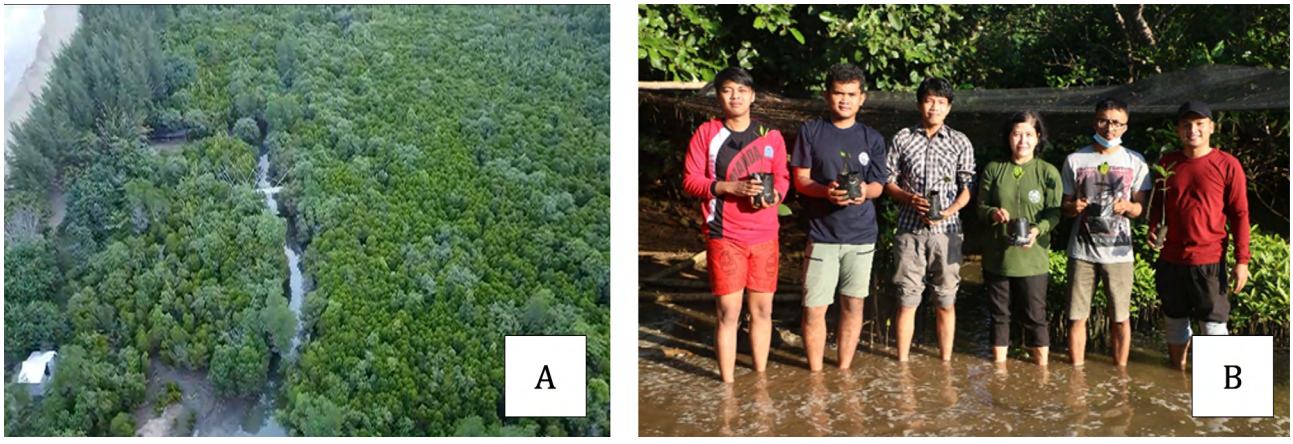

Figure 8 A. Mangrove and shrimp fir forest area at Tamban beach; B. Mangrove nursery area at Tamban beach.

plants that grow on the shore add to the beach's beauty. The brownish white sand that spans over two kilometers appears to be clean. This beach is shaped like a small bay. The beach appeared to be quiet and clean, with just the sound of the waves dominating the atmosphere. Perawan Beach is administratively located in Sidoasri Village, Sumbermanjing Wetan District, Malang Regency. Sidoasri Village was formed from the expansion of Tambakasri Village and is located around 60 km south of Malang City. This beach is not widely known, even by the majority of Malang residents. This beach has not been formally known as a tourist destination, so the existence is still relatively rare. The view of Perawan Beach is shown in Figure 9.

The lengthy and exhausting drive will be more enjoyable by the panoramic views of the mountain ranges along the road, including clove plantations, coffee, cocoa, coconut, and various other huge trees. The road leading up to the beach is in poor condition, with numerous potholes. Only a few fishermen were seen around the beach. Even on holidays, only a few tourists visit this beach. This beach has a large coral island that protects the beach from the big waves of the south coast, called Yangke Island by local residents. According to local residents, this beach frequently attracted dolphins and turtles to lay eggs, so this island is named Perawan (Perawan) Beach.

The potential of the south coast in Malang Regency continues to be maximized by the Malang Regency Government. Currently, the focus of development is given to Perawan Beach by the Department of Culture and Tourism (Dinas Budaya dan Pariwisata) Malang Regency. Some urgent improvements must be made, especially improving the access road to the beach. "Good road conditions will facilitate the tourists to visit this beach. This is the responsibility of the Transportation Department of Malang Regency" (interview with the head of the Department of Highways of Malang Regency). Several other facilities do not yet exist on this beach, such as parking lots, rest areas, homestays, and restaurants.

Most of the residents of Sidoasri Village work in the farming and fishing sectors. Fishermen will go to the sea during the fishing season and return to farming during bad weather. Sidosari Village has 260 hectares of farming area and 544 hectares of plantation area. Some residents also work as animal breeders.

Potential natural resources in Sidoasri Village include agriculture, coastal ecosystems, fisheries, tourism,

Figure 9 A. The left view of Perawan Beach; B. The right view of Perawan Beach; C. Sea waves enter the pipe; D. The fish farming área.

and the maritime industry. Agriculture has potential since it has sufficient land and has been well utilized by the community, as shown by the agricultural products harvested by farmers. The coastal ecosystem, particularly the mangrove ecosystem in Sidoasri Village, has experienced significant damage due to a lack of public knowledge about the need for mangrove conservation. The fisheries sector in Sidoasri Village includes fishing and aquaculture. Fishing at Sidoasri Village is difficult for the community due to the lack of boats and equipment for going to the sea. The port near the sea was not used for its intended purpose because the location was difficult to reach, so it was uninhabited. Therefore, many fishermen in Sidoasri Village chose to send the catch to the Sedangbiru port. Sidoasri Village tourism has great potential, shown by the several beach spots that provide beautiful underwater views. However, only two beaches have been used as tourist attractions in Sidoasri Village, namely Perawan Beach and Klatakan Beach. Still, this beach remains empty due to a lack of promotion and the difficulties of the route leading to the beach area.

3.2 Environmental Sustainability for Tourism Objects with Eco-spatial Edutourism

The results showed that tourism objects on the southern coast of Malang that support ecotourism provide sustainable advantages to the environment. It is shown by the increased of tourism attractions and the sustainability of existing natural resources such as mangroves, coral reefs, pine shrimp, sea pandanus, turtles, and crabs. In addition, the cleanliness in the tourist area is also well maintained. This is supported by research by Benckendorff et al. (2012) stated that tourism objects that offer edutourism would have a sustainability impact, including environmental sustainability. Therefore, sustainability in tourism is important for constructing tourism objects, especially environmental sustainability.

Environmental sustainability should take priority over other tourism indicators, such as visitor growth. The activities conducted include limiting the number of tourists at CMC Tiga Warna by requiring to make a reservation in advance, limiting visit duration to only two hours, requiring visitor groups of no more than ten people to be accompanied by a guide, and closing visits on Thursdays and religious holidays to restore the nature. The research by Pulido-Fernández et al. (2019) showed that increasing environmental sustainability is not depending on the tourism growth principle. Furthermore, in recent decades, the subject of tourism sustainability has gained in popularity. It is due to public administration has become more concerned about the limited use of natural and cultural resources, as well as the negative impact of tourism (Pulido-Fernández et al., 2019). Therefore, appropriate actions related to the environment, society, and even humanity are needed (Dos Santos et al. 2017).

The research by Moscardo (2015) stated that education is a critical component in achieving sustainability. The United Nations designated the years 2005–2014 as the United Nations Decade of Education for Sustainable Development (UNDEFSD) in recognition of the close connection between education and environmental sustainability (Mulà & Tilbury 2009). Therefore, developing tourism objects using edutourism is necessary.

In addition, edutourism in this research also showed the benefits of sustainability in the economy and socio-culture. Tourists who had a meaningful experience will have a positive view of the attractions visited and are likely to return later. The research by Prayag (2009) and Tsai (2016) concluded that positive experiences, knowledge, emotions, and satisfaction from previous trips could influence the decisions and behavior of tourists in the future.

The Protection Forest and Production Forest of the Pesanggrahan Area were used as a habitat for biota diversity. The main organism is a plant community (vegetation), and the existence of this vegetation can provide a habitat for a wide range of species (Syafei 1990). A protected forest is a forest area that primary function is to protect life support systems by regulating water systems, preventing flooding, controlling erosion, preventing seawater intrusion, and keeping soil fertility (Kendeigh 1974; Begon et al. 1986). Therefore, protected forests are critical to the survival of all organisms both inside and outside the area.

The protected forest in the Pesanggrahan area is located on a 97G plot with a Protected Forest (Hutan Lindung) class, covering an area of 106.10 ha. The plants often found are Sapen, Gondang, Ipik, Ringin, Munung, Timoho, and others that grow well. However, some of the protected forest bordering in Pesanggrahan Beach has been currently turned into agricultural land. The changes that will occur may result in unstable ecosystem conditions (Mueller et al. 1974; Barbour 1980). Several protected forest areas in the South Malang area have been opened and developed into tourist destinations. In addition, the construction of the Southern Cross Road (Jalur Lintas Selatan) has divided the Southern Malang Protected Forest Area. It will accelerate the degradation of protected forest ecosystem services and result in a loss of biodiversity in the South Malang area. Therefore, conservation programs are still continuing, including through education.

4 Conclusion

The result found that each beach has unique qualities depend on the surrounding environment and can be developed into an edutourism destination, such as: 1) Kondang Merak beach is dedicated to developing fishing villages and tourist villages related to educational activities about coral reef conservation and tropical forest conservation, 2) Pesanggrahan Beach is dedicated to educating the public about estuary conservation on the Berek River and the preservation of tropical forests that have been intruded upon by the community for agricultural land, as well as the protection of beaches from the threat of illegal sand mining, 3) Bajulmati Beach is dedicated to educating visitors about turtle conservation, pine shrimp conservation, sea pandanus conservation, and aquaculture pond management, 4) CMC Tiga Warna focuses on mangrove protection, crab control, tourist luggage management, and plastic trash management, 5) Tamban beach is dedicated to education on nursery and mangrove planting, and river estuary conservation, and 6) Perawan beach is dedicated to educating the public about the importance of marine palms, pine shrimp, and aquaculture. Edutourism has benefited environmental sustainability, as evidenced by the condition of natural resources in maintained tourist attractions (mangroves, coral reefs, pine shrimp, sea pandanus, turtles, and crabs) and maintained cleanliness at the tourist areas.

The research may be further pursued by examining the distinctiveness and variety of individual coastal ecosystems to determine appropriate educational initiatives, assessing the environmental effects of edutourism on tourist destinations, including biodiversity and natural resource availability, creating sustainable business models and management strategies for edutourism, creating educational programs aimed at enhancing community environmental awareness, and evaluating the impact of edutourism on the welfare of local communities.

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Author contributions

Sumarmi: conceptualization; formal analysis; methodology; writing-original draft; visualization. **Ardiyanto Tanjung:** methodology; validation. **Alfyananda Kurnia Putra:** methodology; visualization. **Siti Zubaidah:** validation. **Rajendra P Shrestha:** supervision. **Agung Suprianto:** writing – review and editing; visualization.

Conflict of interest

The research has no intention or conflict of interest toward individuals or groups.

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