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Sustainable Design Strategies for Malaysia Mangrove Ecotourism

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Abstract
Malaysia's mangrove ecosystem is a valuable natural wonder due to its ability to survive in challenging conditions and the uniqueness that piqued people's curiosity to be part of ecotourism. However, due to the rapid development for economic benefits, it affects the mangrove ecosystem. Besides, issues on natural mangrove resources that incorporate with the ecotourism program also contribute to habitat degradation. Therefore, this research aims to identify the sustainable concept, to analyze the sustainable design characteristics and to study on the sustainable design implementation to the mangrove ecotourism development in Malaysia. The methodology for this research is based on the qualitative method consisting of literature review, precedent studies of mangrove-related ecotourism development. The data were analyzed and evaluated by using the comparative table analysis method to achieve the research's objectives. The result revealed that the main concept of sustainability for mangrove ecotourism development is to ensure the protection of the mangrove ecosystem while promoting tourism activities. Several key principles and characteristics were identified for sustainable design implementation in mangrove ecotourism in Malaysia. Moreover, most of the sustainable characteristics are implemented in most of Malaysia's mangrove areas. This study revealed that sustainable strategies have been applied to most of Malaysia's mangrove ecotourism and required extra research as well as effective strategies to protect the environment.

Keywords: *Mangrove ecosystem, mangrove ecotourism, sustainabile*

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I. INTRODUCTION

Malaysia's natural wonders are its greatest asset, especially the mangrove ecosystems. These distinctive habitats can be found in protected beaches, estuaries, rivers, and even nearshore islands [6]. The mangrove ecosystem in Malaysia provides benefits especially on its high biodiversity and ecology that consist of the mangrove forest and its habitat, which are typically referred to as coastal wetlands. The mangrove trees are special due to their ability to adapt and thrive in saltwater as well as muddy soil. Mangrove trees can grow and survive in certain areas compared to most other plants. It also provides crucial habitable space for various types of birds, animals, and reptiles, as well as serve as a nursery ground for fishes and crabs. Mangroves are also essential for defending coasts against erosion and storm surges. Additionally, mangrove trees function as carbon sinks to mitigate the negative impact to the environment.

The uniqueness of the ecosystem has contributed to the curiosity of exploring the nature that leads to ecotourism practice. It is known as a niche of the tourism industry that specifies responsible travel to natural areas. Numerous benefits are provided by the ecotourism industry, particularly in terms of socioeconomic development. These benefits include employment creation, social and cultural advancement, and state- and national-level income generating [15] [9]. For example, the infrastructure development such as roads, hotels, resorts, power plants in the destination area [20]. In Malaysia, mangrove ecotourism has become a well-liked location for outdoor adventure activities such as boat tours, nature walks and education programs. In Malaysia, some of the ecotourism projects that are related to mangrove environments are Kelip-kelip Kampung Kuantan, Taman Alam, Taman Paya Bakau Sijangkang and others.

However, there are also concerns regarding the excessive ecotourism that would affect the social, cultural, and environmental conditions [28]. The rapid development of ecotourism practices for economic benefits has neglected the core concept of ecotourism [18] [22] which affects the mangrove ecosystem and its habitat. Thus, a sustainable strategy is required to be incorporated as part of mangrove ecotourism especially for the management and building development to ensure the preservation of the mangrove ecosystem. The concept

of sustainable ecotourism will protect local residents' quality of life, provide visitors with top-notch experiences, and maintain the environment's quality on which they all depend [12]. Sustainable approach in tourism development and natural resources at tourist places are currently expanding topics in tourism literature [4]. Therefore, this study provides on the designing for sustainable Malaysia's mangrove ecotourism development through the exploration of the role of determining the sustainable design strategies. Beside, this study will conclude by providing a conceptual framework of sustainable design strategies for future implementation of mangrove ecotourism development. Relevant recommendations and suggestions on the related study will be provided based on the thorough analysis. The study is significant as Malaysia has a unique and diverse feature mangrove ecosystem that could be part of innovation of design strategies of sustainable mangrove ecotourism development. It is a growing potential for the development of ecotourism centers and facilities in the future.

II. LITERATURE REVIEW

The mangrove ecosystem has been collectively known as 'mangal' which refers to the mangrove habitat or ecosystem as a whole, describes the mangrove trees, vegetation, water, soil, and animal and microbial habitats as well as all of the mangrove ecosystem's physical, chemical, and biological components [3]. Numerous epibenthic, infaunal, and meiofaunal invertebrates live in the muddy or sandy substrate of the mangrove environment [7]. The mangal is usually located at coastal wetlands and also rivers. They live in a waterlogged environment that is frequently swamped by tides and flushed by freshwater. The ecosystem is distinctive because it spans the terrestrial, freshwater, and marine environments, unlike any other aquatic or terrestrial ecosystem. They are recognized as the most productive environment because of their distinctiveness.

Mangrove ecosystems are significant for many reasons than just the fact that many endangered plant and animal species call them home. Mangrove ecosystems are an important natural resource because of their unusual diversity, high intrinsic productivity, and significance as a habitat. The ecosystem offers priceless benefits to the environment and the economy. Apart from production of resources for economic contribution, the mangrove ecosystem has a beneficial function as a coastline protector, assimilation of waste, source of food, shelter and sanctuary for fauna, spawning and breeding ground for marine life and also recently proven as a barrier to significantly reduce the height and force of the waves of the tsunami. The benefits are described in three main components on the following subtopic of environmental, economical and social.

In Malaysia, the western coast of Peninsula Malaysia, the southern coast of Sarawak, and the eastern coast of Sabah are where the mangrove habitats are primarily located [2]. Mangroves in Malaysia are primarily of the river-dominated variety and are situated on broad deltaic plains, although there are also intergrades between river- and tide-dominated environments, drowned valley environments, and carbonate environments. Peninsular Malaysia's mangrove forests are mostly found on its west coast, which faces the Malacca Straits, while those on its east, which faces the South China Sea, are sparse and mostly limited to river mouths. Mangrove forests are mostly found in Sarawak state in the mouths of the Sarawak, Rajang, and Trusan-Lawas Rivers, but they are mostly found in Sabah state on its east coast facing the Sulu and Sulawesi Seas. According to Thom (1982), mangroves in Malaysia are mostly found in river deltas, with the Merbok, Matang, Klang, and Rajang deltas exhibiting luxuriant development. Mangrove forests form one of the major wetland types in Peninsular Malaysia, which have been identified as one of the key life support systems on earth.

According to Chong (2006), it is especially situated in the states of Kedah, Perak, Selangor, and Johor on the protected west coast that borders the Straits of Melaka. Mangroves are also heavily populated on significant near-shore islands, such as the Kelang Islands in Selangor and Pulau Kukup in Johor. In places like Port Dickson, Negeri Sembilan, Pulau Pangkor, Perak, and Langkawi, Kedah, small patches of mangrove trees may be seen along the rocky coasts. Mangroves are located along the Straits of Johor and in the estuaries of Sungai Pulai and Sg. Johor, which drains into the Straits of Johor, in the south. Mangrove forests are primarily restricted to the protected estuaries of the Kemaman river in Terengganu and Bebar in Pahang on the east coast. Mangrove forests cover an estimated 107,802 ha of Peninsular Malaysia as of the end of 2006, of which 82,091 ha have been designated as Permanent Reserved Forests (PRFs). The largest mangrove reserves are in Perak, followed by those in Johor and Selangor. Together, the mangrove reserves in Matang (Perak), South Johor (Johor), and Kelang (Selangor) account for 74% of the remaining mangrove forest. Currently, there are about 577,558 ha of mangroves in Malaysia, of which 341,377 ha (59%) are in Sabah, 132,000 ha (23%) are in Sarawak, and 104,181 ha (18%) are on the peninsula [24].

Ecotourism is defined as "*responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education*" [27]. It can enhance local lives by utilizing the extensive variety of natural and cultural ecosystem services offered by mangroves. Mangrove forests can provide additional revenue through the selling of items (such as food and handicrafts) and services (e.g., park user fees, tour guiding, and boat rental). Activities for recreation include boat, boardwalk trips, kayaking, and wildlife watching. Another goal in the case of mature, species-rich forests is biodiversity preservation [5]. Ecotourism is seen as one of the ways to win public support for conservation and sustainable

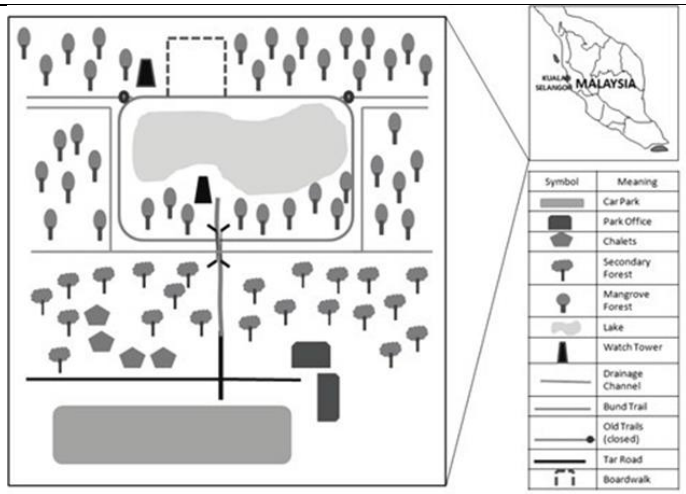
utilization of the mangrove ecosystem. The Kuala Selangor Nature Park in Selangor is a fine example of a nature-cum- recreational park where destructive activities are prohibited. The park had an annual visit of about 40,000 visitors in 1996 [10]. There are many other ecotourism developments regarding mangrove that are available in Malaysia. Therefore, this section will review several case studies of well-known ecotourism development with mangrove environments located in several parts of Malaysia.

a) Taman Alam, Kuala Selangor, Selangor

According to KualaSelangor.com (2022), Kuala Selangor Nature Park (Taman Alam Kuala Selangor) was opened in 1987 and has become a favorite destination among nature and outdoor enthusiasts. A sanctuary for rescued and rehabbed animals, including monkeys, birds, and reptiles, is also located within the park. For those interested in eco-tourism and wildlife, Taman Alam Kuala Selangor is a well-liked vacation spot.

Figure 1: View of Taman Alam Kuala Selangor's facilities

Source : MPKS, 2022

Precedent Study/ Description	Taman Alam Kuala Selangor, Selangor
Location	Kuala Selangor, Selangor
Size Area	296 hectares
Function	Protected space area and sanctuary for rescued and rehabbed animals, including monkeys, birds, and reptiles. The sanctuary includes endangered Silvered Leaf Monkey (Silvery Lutung or Silvery Langur) and other wildlife, including mudskippers, iguanas, eagles, squirrels, king crabs and otters.
Site Plan	 (Tahir et al., 2017)
Programme/ Design components	Walking routes, bird observation towers, educational exhibits, cabin accommodation, visitor amenities

Special characteristic	Three different habitats: inland secondary forests, muddy estuaries and mudflats, and a brackish lake whose ecosystem is regulated by wetland animals

Table 1: Information of Taman Alam Kuala Selangor, Selangor

b) Paya Bakau Sijangkang Recreational Park, Teluk Panglima Garang, Selangor

The initial exploration of the area took place in 1892 by the Indonesian immigrants from Kg Pendamaran, Klang, who later made Kampung Sijangkang their permanent home. Sijangkang is a combination of Pokok Jangkang and the name of the river (stilt trees). This park has a wide variety of species, including birds, monkeys, and reptiles, calling its mangrove forests and coastal wetland ecosystems home. It displays that highlight the local fauna and unique environment. Eco-tourists and animal lovers flock to Paya Bakau Kampung Sijangkang Recreational Park, which is committed to advancing environmental education and conservation. To date, the locals have used crowdfunding to pay for the recreational park.

Figure 2: Broadwalk in mangrove environment
Source: Petit.Go, 2022

Precedent Study/ Description	Paya Bakau Sijangkang Recreational Park
Location	Teluk Panglima Garang, Selangor
Size Area	None
Function	Tourist attraction for mangrove exploration wide variety of species, including birds, monkeys, and reptiles, call its mangrove forests and coastal wetland ecosystems home
Site Plan	None
Programme/ Design components	Walking routes, birdwatching towers, broad walks, picnic sites, camping spaces, and educational displays, visitors amenities like a surau, restrooms, gift stores, a camping area, and team-building activities.
Special characteristic	Mangrove boardwalk with informational signages along the way with exploration of wide variety of species, including birds, monkeys, and reptiles, call its mangrove forests and coastal wetland ecosystems home

Table 2: Information of Paya Bakau Sijangkang Recreational Park

c) Matang Mangrove Forest Reserve Eco Park, Kuala Sepetang, Perak

According to Romanach et al., (2018), Matang Mangrove Forest Reserve Eco Park is an eco-tourism destination. It is renowned for having a sizable mangrove forest, which serves as a crucial home for a variety of animals, including birds, primates, and reptiles. For those who enjoy the outdoors and ecotourists interested in learning more about the distinctive ecosystems of the area, Matang Mangrove Forest Reserve Eco Park is a well-liked site.

Figure 3: Boardwalk and amenities facilities in Matang Eco Park

Source: Romanach et al., 2018

Precedent Study/ Description	Matang Mangrove Forest Reserve Eco Park
Location	Kuala Sepetang, Perak
Size Area	40,000 acres
Function	A crucial home for a variety of animals, including birds, primates, and reptiles.

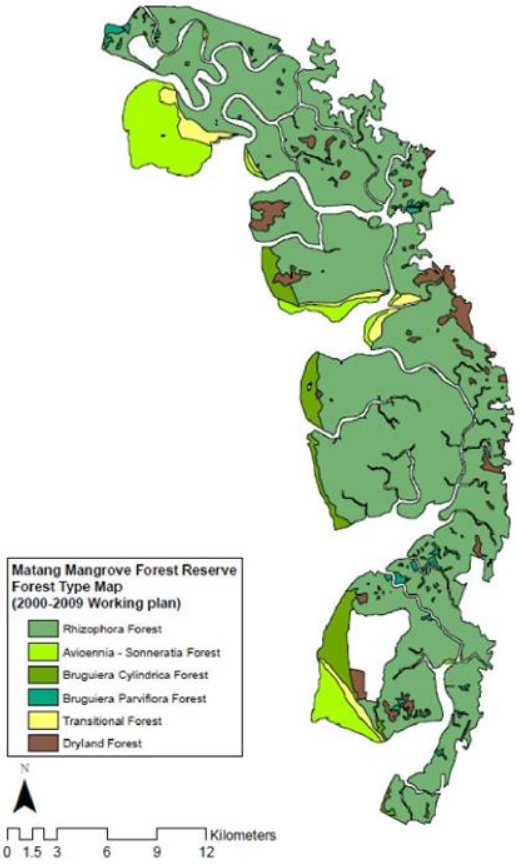
Site plan	 Aziz, 2015
Programme/ Design components	Walking trails, boardwalks, and birdwatching towers provides educational exhibits, camping options, and leisure pursuits like kayaking and bird watching
Special characteristic	Malaysia's largest forest reserve and additional managed for the production of lumber

Table 3: Information of Matang Mangrove Forest Reserve Eco Park

d) Taman Mangrove Point, Pelabuhan Klang, Selangor

Mangrove Point is a Selangor Maritime Gateway social project effort that spans around 70 acres of state land and Hutan Simpan Kekal in Kawasan 14, close to the mouth of the Klang River. This project, a partnership with Jabatan Perhutanan Negeri Selangor, aims to create a new ecotourism destination as well as a public recreation space open to both locals and visitors from across the world. Mangrove Point is home to a distinctive mangrove habitat with surrounding nature that, by creating a biophilic environment, promotes the elements of meditation, health, and well-being.

Figure 4: The site of Mangrove Point
Source: SMG, 2022

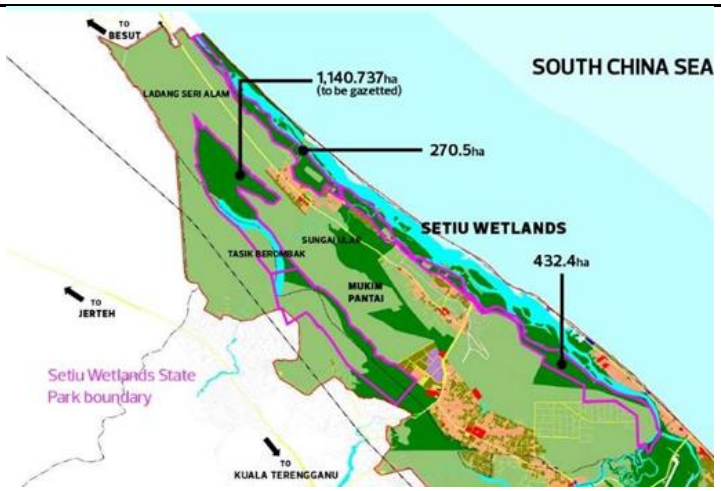
Precedent Study/ Description	Mangrove Point
Location	Pelabuhan Klang, Selangor
Size Area	Social project effort that spans around 70 acres of state land and Hutan Simpan Kekal in Kawasan 14
Function	New ecotourism destination as well as a public recreation space open to both locals and visitors from across the world
Site Plan	
Programme/ Design components	Designated information centre, boardwalk visitors can go fishing, picnicking, and birdwatching in Klang River
Special characteristic	Mangrove Point received recognition from the Institute of Landscape Architects of Malaysia (ILAM) through the Malaysia Landscape Architecture Award 11 (MLAA 11) in the category of Landscape Analysis and Study Award.

Table 4: Information of Mangrove Point

e) Setiu Wetlands, Terengganu

Setiu District, Terengganu, Malaysia has the Setiu Wetland, also known as Tanah Bencah Setiu or Laguna Setiu. It is a component of the wider Setiu-Chalok-Bari-Merang basin wetland complex as well as the Setiu River basin. Setiu Wetlands is the largest natural wetland on Peninsula Malaysia's East Coast. Setiu Wetlands State Park has another boundary of 1,088 hectares which will be gazetted in phase two. The area's ecological variety, the need to preserve the ecosystem, and the potential for ecotourism all played a role in the decision to establish the state park (Mohamad, 2022).

Figure 5: Mangrove boardwalk in Setiu Wetland
Source: New Strait Times, 2016

Precedent Study/ Description	Setiu Wetlands
Location	Permaisuri, Terengganu
Size Area	23,000 hectares
Function	Component of the wider Setiu-Chalok-Bari-Merang basin wetland complex as well as the Setiu River basin
Site plan	 The Edge Market, 2022
Programme/ Design components	None

Special characteristic	14-kilometer lagoon and a variety of freshwater, brackish, and marine ecosystems (Malay Mail, 2022). 9 different ecosystem within one wetland park (sea, coastal, muddy area, lagoon, estuary, river, island, coastal water forest and mangrove swamp forest

Table 5: Information of Setiu Wetlands

f) Firefly Sanctuary Kampung Kuantan, Kuala Selangor, Selangor

A village called Kampung Kuantan can be found in Kuala Selangor, Malaysia. It is located close to the Selangor River estuary on Peninsular Malaysia's west coast. Mangrove woods that provide a habitat for a diverse range of plant and animal species surround the settlement. The community is well-known for its mangrove forest, which supports a sizable firefly population. The "glow of the village" is the Kampung Kuantan fireflies, a popular tourist destination. Due to the opportunity for tourists to watch firefly, learn about the ecology and conservation of these insects, as well as the mangrove habitat in which they dwell, and to take boat trips to view the fireflies at night, the hamlet is also well-liked among ecotourism aficionados. Visitors can join a trip to observe birds in the mangrove forest, which is also a haven for many different bird species.

Figure 6: Boat decking area overlook mangrove environment along river

Source: Libur, 2021

Precedent Study/ Description	Firefly Sanctuary Kampung Kuantan
Location	Kuala Selangor, Selangor
Size Area	None
Function	Tourist attraction for firefly
Site Plan	None
Programme	Firefly sightseeing, boat tour, fishing
Special characteristic	Firefly habitat within mangrove environment several different kinds of mangrove trees, including Rhizophora, Bruguiera, Avicennia, and Sonneratia. Other animals that live in the mangrove habitat include birds, fish, crustaceans, and mollusks. In addition to seeing many bird species, including kingfishers, herons, and egrets, visitors can also see mudskippers, fiddler crabs, and mangrove crabs in the mangrove wetlands.

Table 6: Information of Firefly Sanctuary Kampung Kuantan

III. METHODOLOGY

This study applied a qualitative method that consists of literature review, precedent study and comparative analysis to achieve the research objectives. The methodology process starts with literature review that consists of data collection via reading materials and supported with five selected precedent studies. Next, all data is presented through table, graph and pie chart. Datas is analyzed and synthesized via comparative analysis to determine the sustainable design strategies of mangrove ecotourism development in Malaysia.

Research Method 1: Literature Review

The first research methodology is literature and document review. Literature and documents can be any of such as journal articles, books, internet source material and any physical or unphysical reading materials that related to the main three keywords mentioned will be identified and collected to be analyzed. Keywords of the mentioned subjects are used for initial search. The main database for data collection of this research is through journal articles. Journal articles and related reading materials are mostly obtained online using Google Scholar. While for physical or unphysical reading material such as books are obtained through Google Books or UiTM Library. Relevant data related to the definitions, concepts, characteristics, principles and many more will be selected for data collection. The synthesis of data will be classified into tables as finalization of data collection and also for easier reference.

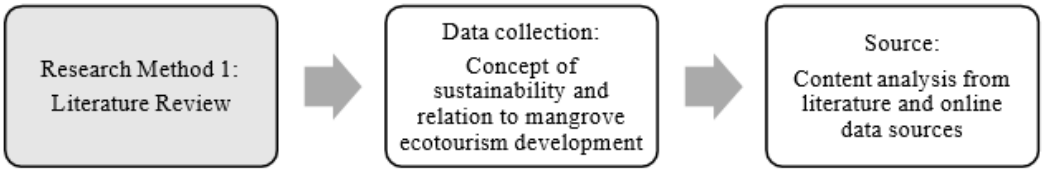


Figure 7: Research method 1

Research Method 2: Precedent Studies

The second research method is precedent study and case study. It is a study involving researching, evaluating and synthesizing information from existing projects, design or buildings. This study will be specified on ecotourism development that is related to mangrove. The limitation is applied so specific precedent and case study development will be chosen. First, the precedent and case study chosen must be related to mangrove. Second, the development consists of sustainable design characteristics applied. Thirdly, the development is situated in the same or similar climate to Malaysia. Therefore, extraction of suitable data from precedent and case study can be obtained.

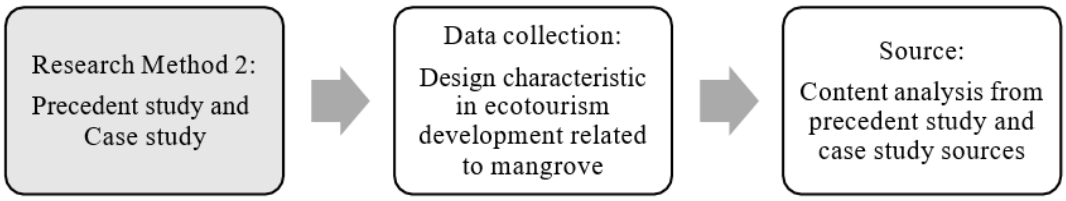


Figure 8: Research method 2

Research Method 3: Data Findings: Comparative Analysis

The third and last research method for this study is comparative analysis of synthesized data. It is a process of comparing and contrasting two or more items, in order to identify similarities and differences and to gain a deeper understanding of the subject. The data that is obtained from the first and second research method will be compared in using this third research method. The comparative analysis will produce the final collection of data which is the result. The result will produce the final conclusion of identification of sustainable design strategies of mangrove ecotourism development in Malaysia.

Figure 9: Research method 3

IV. RESULT AND DISCUSSION

a) The concept of sustainable in mangrove ecotourism development

The concept of sustainability, which refers to the ability to consistently maintain a process over time and involves balancing the social, economic, and environmental aspects. Sustainable use of natural resources is consistent with ecotourism, and sustainable mangrove ecotourism development is necessary to conserve the ecosystem while enjoying it without degradation. A key principle of sustainable mangrove ecotourism development is identified based on the concept of sustainability as following:
- Development is design to minimize environmental impact
- Development is design to respect and protect the cultural and nature of local context through sensitivity
- Development is design to ensure economic benefits without degrading the natural resources
- Involving local communities understanding and awareness for future sustainability
- Continuously monitoring and evaluating impacts of tourism activities towards environment

b) The sustainable design strategies for mangrove ecotourism development
The Table 1 shows the sustainable design strategies identified based on content literature analysis for mangrove ecotourism development:

Sustainable Approach	Description	Design characteristic
The application of the sustainable materials	-The application of local and sustainable materials, such as bamboo, rammed earth, and reclaimed wood, can reduce the environmental impact of construction and promote conservation of natural resources. -Reduce emission of gasses -Local, natural, eco-friendly, sustainable or recycle material	-Lightweight construction -Reduce damage of natural mangrove context -Durability and sensitivity to mangrove environment -Imitate surrounding context of nature elements especially wood
Energy efficiency	-The incorporation of energy- efficient systems from energy efficient technologies that can reduce the energy consumption of ecotourism accommodations and promote conservation of resources. Also, the development should be designed to incorporate sustainable tourism infrastructure.	-Renewable energy resources (solar panels, green roof, rainwater harvesting, natural ventilation) -Locally sourced materials -Recycling and waste management system -Water treatment system
Bioclimatic design	-The use of bioclimatic design principles can reduce the need for artificial cooling and heating systems and promote the well-being of tourists. Enhance natural climatic conditions	-Cross and natural ventilation -North south orientation -Greeneries shadings
Adaptability and flexibility	-The design of ecotourism accommodations that are adaptable and flexible can allow for changes in use over time and reduce the need for new construction and are able to withstand extreme weather conditions, so they can last long and minimize the need for frequent repairs or replacement. Also, the implementation of open spaces that can be used for community gatherings, recreation, and conservation, which can help to promote a sense of community and a connection to the natural environment.	-Flexibility, seamless, transparency -Open planning
Low-impact design	-Designing for low-impact on the environment and ecosystems can minimize the negative environmental impact of tourism development. -Should be designed to encourage sustainable transportation to reduce dependence on cars	-Natural drainage system -Preserving natural landscape and greeneries -Sustainable transportation encouragement (bike, public transport access, easy walkability)
Natural Elements of Site	The incorporation of water elements, consideration towards topography of site, wind direction, sun direction and many other related to natural elements that existed on site for consideration towards site sensitivity	-Blend in with natural mangrove environment -Incorporate with slope design -Increase nature footprint -Minimal artificial landscaping -Green pocket and walls, Vertical Garden, Breathable walls
Form and Space	-development should be designed to reflect local culture and traditions, which can help to promote a sense of place and community identity -Embrace shape and elements of nature	-Motives, pattern and process of nature -Respect and respond to nature

Table 7: Sustainable design strategies for mangrove ecotourism development

c) Identification of sustainable design strategies for mangrove ecotourism development in Malaysia

The Table 2 below shows the sustainable design characteristic identified in mangrove ecotourism development in Malaysia:

Precedent Study/ Sustainable Design Characteristic	CS1: Taman Alam	CS 2: Sijangkang	CS3: Matang	CS4: Mangrove Point	CS5: Setiu Wetland	CS6: Firefly Sanctuary Kampung Kuantan	TOTAL
The application of sustainable material							
Lightweight construction		/			/		2
Local, natural, eco-friendly, sustainable or recycle material	/	/	/	/	/	/	5
Energy efficiency							
Solar Panels							0
Green Roofs							0
Rainwater harvesting							0
Recycling and waste management system	/						1
Water treatment system							0
Bioclimatic Design							
Natural ventilations	/	/	/	/	/	/	5
Shadings	/						1
Orientation	/					/	2
Adaptability and flexibility							
Able to withstand extreme weather	/	/	/	/	/	/	5
Open planning design	/	/	/	/	/	/	5
Low-impact design							
Natural drainage systems	/	/	/	/	/	/	5
Preserving natural landscapes	/	/	/	/	/	/	5
Sustainable transportation and walkability	/	/	/	/	/	/	5
Natural elements of site							
Incorporation of water elements	/	/	/	/	/	/	5
Topography of site,	/	/	/	/	/	/	5
Increase nature footprint	/	/	/	/	/	/	5
Form and space							
Aesthetic nature design elements			/	/			2

Enhance for indoor environmental quality	/	/	/	/	/	/	5
Reflect local culture and traditions	/	/	/	/			4

Table 8: Data from the precedent study

Table 2 indicates that all of the mangrove development fulfills the 3 characteristics which are adaptability and flexibility, low-impact design and natural elements on site. Considered as among the main elements, these categories are necessary to be provided that symbolize the uniqueness of each mangrove development in Malaysia. This data also serves as an indicator for future mangrove development to implement these characteristics that can be part of the main attraction especially for the tourism spot. There are some elements from different characteristics that are provided by all of the mangrove development which are local, natural, eco- friendly, sustainable or recycled material, natural ventilations and the enhancement for indoor environmental quality. These are other added elements vitally provided as they respond to the existing natural site context as well as to express the identity of the mangrove development. Solar panels, green roofs, rain water harvesting and water treatments are elements that should be implemented to improve more on the sustainability approach for mangrove areas. These strategies may depend on the design needed to be implemented or due to the limitation on certain aspects to be part of the development.

V. CONCLUSION

The existing development in Malaysia indicates that most of the mangrove ecotourism cooperates with sustainable design strategies. All of the ecotourism mangrove development is required to provide efficient energy strategy due to the lowest contribution for sustainable mangrove development. Therefore, in order to achieve the full concept of sustainable ecotourism for mangrove, all the elements needed to be taken for design implementation. The existing elements are required to remain and improve to respond to the future requirements and site issues. This study indicates that sustainable development in architecture is a holistic approach that involves balancing the needs of the environment, economy, and people to create built environments that are resilient, functional, and contribute to the well-being of the people who use them, and the planet.

REFERENCES

[1]. Aziz, A. (2015). Integrating a REDD+ Project into the management of a production mangrove forest in Matang Forest Reserve, Malaysia. *Environmental Science - Semantic Scholar*.

[2]. Chong. (2006). Sustainable utilization and management of Mangrove. *Aquatic Ecosystem Health & Management*.

[3]. Duke. (1992). Mangrove floristics and biogeography. In: A.I. Robertson and D.M. Alongi (Eds.), Tropical Mangrove Ecosystems. *Coastal and Estuarine Studies*, 63–100.

[4]. Hassan, S. (2000). Determinants of market competitiveness in an environmentally sustainable tourism industry. J. Travel Res., 239-245.

[5]. Jurgene, H. P., Daniel , A. F., Hannake, V. L., & Shing , Y. L. (2019). The Mangrove Ecosystem. *World Sea: An Environmental Evaluation*.

[6]. Kamaruzaman, J. (2009). Managing Sustainable Mangrove Forests in Peninsular Malaysia. *Journal of Sustainable Development* 1(1) : 88-96

[7]. Kathiresan, K., & Bingham, B. L. (2001). Biology of Mangroves and Mangrove Ecosystem. *Advances in Marine Biology*.

[8]. KualaSelangor.com. (2022). *Kuala Selangor Nature Park (Taman Alam Kuala Selangor)*. Retrieved from KualaSelangor.com: https://www.kuala-selangor.com/kuala-selangor-attraction/kuala-selangor-nature-park.html?fbclid=IwAR2zBxmE2HW-ZvzxiAgPLi- iOvvPw8iahK8S-LnfJgMWqJ9k4mOzbFCpxKk

[9]. Lanza, A., & Pigliaru, F. (2000). Tourism and Economic Growth: Does country's size.

[10]. Leong, L. F. (2009). Economic valuation of the mangrove forest in Kuala Selangor, Malaysia.

[11]. Libur. (2021). Kampung Kuantan, Kuala Selangor 'lubuk' udang galah sepit biru idaman ramai. https://www.libur.com.my/kampung-kuantan-kuala-selangor-lubuk-udang-galah-sepit-biru-idaman-ramai/

[12]. McIntyre, S., Lavorel S. and Tremont, R. M. (1995). Plant Life-History Attributes: Their Relationship to Disturbance Response in Herbaceous Vegetation. Journal of Ecology 8391) : 31-44

[13]. Majlis Perbandaran Kuala Selangor (MPKS). (2022). Negeri tubuh jawatankuasa pantau projek Taman Alam Kuala Selangor. https://selangorkini.my/2022/11/negeri-tubuh-jawatankuasa-pantau-projek-taman-alam-kuala-selangor/

[14]. Mohamad, A. (2022). *Tanah Bencah Setiu diselamatkan - Terengganu* . Retrieved from Utusan Online: https://www.utusan.com.my/berita/wilayah/terengganu/tanah-bencah- setiu-diselamatkan-1.73958#sthash.UNENppSX.dpuf

[15]. Mohd Rusli, Y., Ahmad , S., Mohd Farid, M., & Alias , R. (2007). Local Economic Benefits of Ecotourism Development in Malaysia: The Case of Redang Island Marine Park. International Journal of Economics and Management, 363-384.

[16]. New Strait Time. (2016). Turn Setiu wetlands into a state park.https://www.nst.com.my/news/2016/10/180834/turn-setiu-wetlands-state-park

[17]. Petit.Go. (2022). *Paya Bakau Kampung Sijangkang Recreational Park* . Retrieved from Petit.Go: https://www.petitgo.com/listing_display?listingid=346

[18]. Reynolds, P. C., & Braithwaite, D. (2001). Towards a conceptual framework for wildlife tourism. 31-42.

[19]. Romañach, S. D. (2018). Conservation and restoration of mangroves: Global status, perspectives, and prognosis. . *Ocean & Coastal Management*.

[20]. Shaalan, M. I. (2005). Sustainable tourism development in the Red Sea of Egypt threats and opportunities. *Journal of Cleaner Production*, 83-87.
[21]. SMG. (2022). *Mangrove Point*. Retrieved from selangormaritimegateway: https://www.selangormaritimegateway.com/projects/developments/mangrove- point/#1569997798875-aa4347d7-5e9d
[22]. Stueve, A., & Cook, S. (2002). Geotourism Study: Phase 1 Executive Summary.
[23]. Tahir, N. A., Ismail, A., & Rahman, F. (2017). Daily Activity Budget of Silver Leaf Monkeys (Trachypithcus cristatus) in Kuala Selangor Nature Park (KSNP), Peninsular Malaysia. *Research Gate*.
[24]. Tan, K. H.& Basiron, N. M. (2000). Conservation , development and management of mangrove resources in Malaysia.: Issues, Challenges and Opportunities. Hydrobiologi 5: 110-134
[25]. The Edge Market. (2022). Gelam forests may thrive again. https://theedgemalaysia.com/article/gelam-forests-may-thrive-again.
[26]. Thom, B. G., 1982. Mangrove ecology a geomorphological perspective. Mangrove Ecosystems in Australia. Australian National University Press, Canberra.
[27]. TIES. (2022). *What is ecotourism?* Retrieved from www.ecotourism.org/what-is-ecotourism
[28]. United Nations Environmental Program . (2003). About Ecotourism.